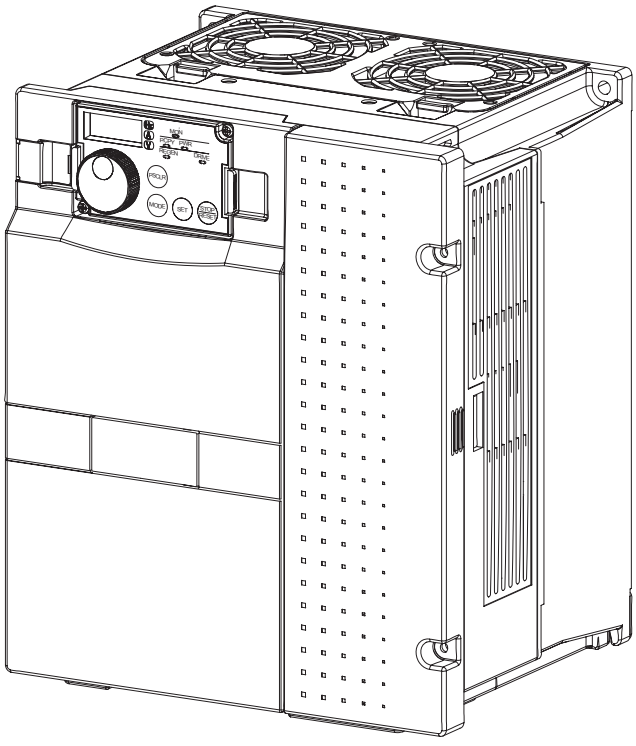
MITSUBISHI ELECTRIC

INVERTER FR-HC2 INSTRUCTION MANUAL

High power factor converter

FR-HC2-7.5K to 75K
FR-HC2-H75K, H110K, H280K, H560K



OUTLINE 1

INSTALLATION AND WIRING 2

PARAMETERS 3

PROTECTIVE FUNCTIONS 4

MAINTENANCE AND INSPECTION 5

SPECIFICATIONS 6

Thank you for choosing the Mitsubishi High Power Factor Converter.
This Instruction Manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the converter, please read this manual carefully to use the equipment to its optimum.
Please forward this manual to the end user.

Safety Instructions

Do not attempt to install, operate, maintain or inspect the converter until you have read through this Instruction Manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION"

⚠WARNING	Incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

The ⚠CAUTION level may even lead to a serious consequence according to conditions.
Both instruction levels must be followed because these are important to personal safety.

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

⚠WARNING

- While power is ON or when the converter is running, do not open the front cover. Otherwise you may get an electric shock.
- Do not run the converter with the front cover removed. Otherwise you may access the exposed high voltage terminals or the charging part of the circuitry and get an electric shock.
- Even if power is OFF, do not remove the front cover except for wiring or periodic inspection. You may accidentally touch the charged converter and get an electric shock.
- Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.) Any person who is involved in wiring or inspection shall wait for at least 10 minutes after the power supply has been switched OFF and check that there is no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.
- This converter must be earthed (grounded). Earthing (grounding) must conform with the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 536 class 1 and other applicable standards).
- Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.
- The product body must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Setting dial and key operations must be performed with dry hands to prevent an electric shock. Otherwise you may get an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.
- Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.
- Do not touch the printed circuit board or handle the cables with wet hands. Otherwise you may get an electric shock.

2. Fire Prevention

⚠CAUTION

- The converter must be installed on a nonflammable wall without holes. Mounting it to or near flammable material can cause a fire.
- If the converter has become faulty, the power of the converter must be switched OFF. A continuous flow of large current could cause a fire.

3.Injury Prevention

⚠WARNING

- The voltage applied to each terminal must be the ones specified in the Instruction Manual. Otherwise burst, damage, etc. may occur.
- The cables must be connected to the correct terminals. Otherwise burst, damage, etc. may occur.
- Polarity must be correct. Otherwise burst, damage, etc. may occur.
- While power is ON or for some time after power-OFF, do not touch the converter, reactor 1, reactor 2, outside box, filter capacitor, and limit resistor as they will be extremely hot. Touching these devices can cause a burn.

4. Additional Instructions

The following instructions must be also followed. If the product is handled incorrectly, it may cause unexpected fault, an injury, or an electric shock.

(1) Transportation and mounting

⚠CAUTION

- The product must be transported in a suitable method which corresponds to the weight. Failure to do so may lead to injuries.
- Do not stack the boxes containing products higher than the number recommended.
- The product must be installed to the position where withstands the weight of the product according to the information in the Instruction Manual.
- Do not install or operate the converter if it is damaged or has parts missing.
- When carrying the converter, do not hold it by the front cover or setting dial; it may fall off or fail.
- Do not stand or rest heavy objects on the product.
- The mounting orientation must be correct.
- Foreign conductive objects must be prevented from entering the converter. That includes screws and metal fragments or other flammable substance such as oil.
- As the converter is a precision instrument, do not drop or subject it to impact.
- The product must be used under the following environment. Otherwise the converter may be damaged.

Environment	Surrounding air temperature	-10°C to +50°C (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature	-20°C to +65°C *1
	Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
	Altitude/ vibration	Maximum 1,000m above sea level. 5.9m/s^2 or less*2 at 10 to 55Hz (directions of X, Y, Z axes)

*1 Temperature applicable for a short time, e.g. in transit.
*2 2.9m/s^2 or less for the 280K or higher.

(2) Trial run

⚠CAUTION

- Before starting the operation, each parameter must be confirmed and adjusted. A failure to do so may cause some machines to make unexpected motions.
- Before starting the operation, the wiring of each peripheral device must be checked. Faulty wiring may cause some machines to make unexpected motions.

(3) Usage

⚠WARNING

- Any person must stay away from the equipment when the retry function is set as it will restart suddenly after a trip.
- Since pressing the STOP RESET key may not stop the operation depending on the function setting status, separate circuit and switch that make an emergency stop (power OFF, etc.) must be provided.
- OFF status of the inverter start signal must be confirmed before resetting a fault of the converter. If reset is performed with the start signal ON, the converter starts suddenly.
- The load must be always inverters. Connection of any other electrical equipment to the converter output may damage the equipment.
- Do not modify the equipment.
- Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the product.

⚠CAUTION

- Do not use a magnetic contactor on the power input side for frequent starting/stopping of the converter or the inverter. Otherwise the life of the converter or the inverter decreases.
- The effect of electromagnetic interference must be reduced by using a noise filter or by other means. Otherwise the electronic equipment used near the converter or the inverter may be affected.
- When parameter clear or all parameter clear is performed, the required parameters must be set again before starting a operation because all parameters return to the initial value.
- Before running a converter or an inverter which had been stored for a long period, inspection and test operation must be performed.
- For prevention of damage due to static electricity, nearby metal must be touched before touching this product to eliminate static electricity from your body.

(4) Emergency stop

⚠CAUTION

- A safety backup such as an emergency brake must be provided to prevent hazardous condition to the machine and equipment in case of the converter and inverter failure.
- When the breaker, which is installed in the input side of the converter, trips, the wiring must be checked for a fault (short circuit), and internal parts of the converter and the inverter for a damage, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.
- When any fault occurs, take an appropriate corrective action, then reset the converter, and resume the operation.

(5) Maintenance, inspection and parts replacement

⚠CAUTION

- Do not carry out a megger (insulation resistance) test on the control circuit of the converter.

(6) Disposal

⚠CAUTION

- The converter must be treated as industrial waste.

(7) General instruction

Many of the diagrams and drawings in this Instruction Manual show the converter without a cover or partially open for explanation. Never operate the converter in this manner. The cover must be always reinstalled and the instruction in this Instruction Manual must be followed when operating the converter.

CONTENTS

1 OUTLINE 1

1.1 Pre-operation instructions 2

1.1.1 Features of FR-HC2 (high power factor converter) 2
1.1.2 Japanese harmonic suppression guideline 2
1.1.3 Product checking and parts identification 5

1.2 Converter and peripheral devices 7

1.3 Precautions for selecting peripheral devices 8

1.3.1 Measures against noises (EMI) 8
1.3.2 Peripheral device list 11
1.3.3 Selecting the rated sensitivity current for the earth leakage circuit breaker 13

2 INSTALLATION AND WIRING 15

2.1 Removal and installation of the converter (FR-HC2) front cover 16

2.2 Removal and installation of the outside box (FR-HCB2) front cover 18

2.3 Installation 19

2.3.1 Converter placement 19

2.4 Protruding the heatsink 21

2.4.1 When using a heatsink protrusion attachment (FR-A7CN) 21
2.4.2 Heatsink protrusion for 280K or higher 21

2.5 Installation of peripheral devices 23

2.5.1 Installation of reactor 1 and reactor 2 23
2.5.2 Installation of the outside box (FR-HCB2-7.5K to 75K, FR-HCB2-H75K, H110K) 24
2.5.3 Installation of filter capacitor (FR-HCC2-H280K, H560K) 25
2.5.4 Installation of inrush current limit resistor (FR-HCR2-H280K, H560K) 25
2.5.5 Installation of stepdown transformer (FR-HCM2-H280K, H560K) 26

2.6 Main circuit terminal specifications 27

2.6.1 Description of main circuit terminal 27
2.6.2 Terminal arrangement of the main circuit terminal 27
2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals 29

2.7 Wiring of main circuit (FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K) 31

2.7.1 Connection diagram (when using with the FR-A700 series) 31
2.7.2 Wiring of main circuit 33

2.8 Wiring of main circuit (FR-HC2-H280K) 38

2.8.1 Connection diagram (when using with the FR-A700 series) 38
2.8.2 Wiring of main circuit 40

2.9 Wiring of main circuit (FR-HC2-H560K) 44

2.9.1 Connection diagram (when using with the FR-A700 series) ... 44
2.9.2 Wiring of main circuit ... 46

2.10 Notes on earthing (grounding) ... 50

2.11 Compatible inverter for the high power factor converter ... 51

2.12 Wiring of several inverters to one converter ... 52

2.13 Wiring of control circuit ... 54

2.13.1 Description of control circuit terminal ... 54
2.13.2 Changing the control logic ... 56
2.13.3 Control circuit terminal layout ... 58
2.13.4 Wiring instructions ... 59
2.13.5 When connecting the operation panel or parameter unit using a connection cable ... 60
2.13.6 Communication operation (computer link operation) ... 60

3 PARAMETERS 61

3.1 Operation panel (FR-DU07-CNV) ... 62

3.1.1 Names and functions of the operation panel (FR-DU07-CNV) ... 62
3.1.2 Basic operation (factory setting) ... 63
3.1.3 Changing the parameter setting value ... 64

3.2 Parameter unit (FR-PU07), parameter unit with battery pack (FR-PU07BB(-L)) ... 65

3.2.1 Parts identification of the parameter unit ... 65
3.2.2 Explanation of keys ... 65
3.2.3 Monitoring function ... 66
3.2.4 Function menu ... 67

3.3 Parameter list ... 69

3.4 Description of parameters ... 71

3.4.1 Displaying and hiding extended parameters (Pr. 0) ... 71
3.4.2 Input frequency to converter (Pr. 1, Pr. 2) ... 71
3.4.3 Input terminal function selection (Pr. 3 to Pr. 7) ... 72
3.4.4 Operation selection of SOF signal and OH signal (Pr. 8, Pr. 9) ... 73
3.4.5 Output terminal function selection (Pr. 10 to Pr. 16) ... 74
3.4.6 DC voltage control (Pr. 22 to Pr. 24, Pr. 80, Pr. 81) ... 75
3.4.7 Input current detection function (Y12 signal, Y13 signal, Pr. 25 to Pr. 30) ... 76
3.4.8 Displaying the life of the converter parts (Pr. 31 to Pr. 33) ... 77
3.4.9 Maintenance timer alarm (Pr. 34, Pr. 35) ... 78
3.4.10 Cooling fan operation selection (Pr. 36) ... 79
3.4.11 Instantaneous power failure detection hold (Pr.44) ... 79
3.4.12 Reference of the terminal FM (pulse train output) and terminal AM (analog output) (Pr. 45, Pr. 49, Pr. 51, Pr. 53, Pr. 55, Pr. 56) ... 80
3.4.13 DU/PU, terminal FM/AM monitor display selection (Pr. 46 to Pr. 48, Pr. 50, Pr. 52, Pr.54) ... 82
3.4.14 Operation selection at instantaneous power failure (Pr. 57) ... 85

3.4.15 Free parameter (Pr. 58, Pr. 59) ... 86
3.4.16 Key lock selection of operation panel(Pr. 61) ... 86
3.4.17 Retry function (Pr. 65, Pr. 67 to Pr. 69) ... 87
3.4.18 Reset selection/disconnected PU detection/PU stop selection (Pr. 75) ... 88
3.4.19 Parameter write disable selection (Pr. 77) ... 90
3.4.20 Current control (Pr. 82, Pr. 83) ... 91
3.4.21 Wiring and configuration of PU connector ... 91
3.4.22 Initial settings and specifications of RS-485 communication (Pr. 117 to Pr. 124) ... 93
3.4.23 Mitsubishi inverter protocol (computer link communication) ... 94
3.4.24 Initial setting and specification for the CC-Link communication function (Pr.542 to Pr.544) ... 105
3.4.25 Operation at a communication error (Pr.500 to Pr.502) ... 112
3.4.26 Communication EEPROM write selection (Pr. 342) ... 113
3.4.27 Setting of the parameter unit and operation panel (Pr. 145, Pr. 990, Pr. 991) ... 114
3.4.28 Terminal FM and AM calibration (calibration parameter C0 (Pr. 900), C1 (Pr. 901)) ... 115

3.5 Parameter clear / All parameter clear ... 117

3.6 Parameter copy and parameter verification ... 118

4 PROTECTIVE FUNCTIONS 121

4.1 Troubleshooting ... 122

4.2 Reset method of protective function ... 122

4.3 List of fault and alarm indications ... 123

4.4 Causes and corrective actions ... 124

4.5 Correspondences between digital and actual characters ... 131

4.6 Check and clear of the faults history ... 132

4.7 Check first when you have a trouble ... 134

5 MAINTENANCE AND INSPECTION 135

5.1 Inspection items ... 136

5.1.1 Daily inspection ... 136
5.1.2 Periodic inspection ... 136
5.1.3 Daily and periodic inspection list ... 137
5.1.4 Checking the converter module ... 138
5.1.5 Cleaning ... 138
5.1.6 Replacement of parts ... 139

5.2 Measurement of main circuit voltages, currents and powers ... 143

5.2.1 Insulation resistance test using megger ... 144
5.2.2 Pressure test ... 144

6 SPECIFICATIONS 145

6.1 Rated specifications 146

6.2 Common specifications 147

6.3 Outline dimensions 148

6.3.1 Converter (FR-HC2) 148
6.3.2 Reactor 1 (FR-HCL21) 153
6.3.3 Reactor 2 (FR-HCL22) 157
6.3.4 Difference between the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22). 161
6.3.5 Outside box (FR-HCB2) 162
6.3.6 Filter capacitor (FR-HCC2) 166
6.3.7 FR-HCM2 167
6.3.8 Inrush current limit resistor (FR-HCR2) 171
6.3.9 Parameter unit 172

APPENDICES 173

Appendix 1 Instruction code list 174

Appendix 2 Instructions for compliance with the EU Directives 175

Appendix 3 Instructions for UL and cUL 177

<Abbreviations>
- Converter: Mitsubishi high power factor converter (FR-HC2)
- FR-HC2: Mitsubishi high power factor converter
- Inverter: Mitsubishi inverter that supports FR-HC2
- Reactor 1: Filter reactor 1 (FR-HC21)
- Reactor 2: Filter reactor 2 (FR-HC22)
- Limit resistor: Inrush current limit resistor (FR-HCR2)
- Stepdown transformer: Stepdown transformer for power source of MCs
- Limit MC: Inrush current limit MC
- Pr. : Parameter number (Number assigned to function)
- PU: Operation panel or option parameter unit (FR-PU07/FR-PU07BB)
- FR-PU07: Option parameter unit (FR-PU07/FR-PU07BB)
- PU operation: Operation using the PU
- External operation: Operation using the control circuit signals

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<Marks>

REMARKS: Additional helpful contents and relations with other functions are written.

Note: Contents requiring caution or cases when set functions are not activated are written.

POINT: Useful contents and points are written.

☞: Content and description of an alarm or fault are written.

1 OUTLINE

This chapter explains the "OUTLINE" for use of this product. Always read the instructions before using the equipment.

1.1 Pre-operation instructions 2
1.2 Converter and peripheral devices 7
1.3 Precautions for selecting peripheral devices 8

1.1 Pre-operation instructions

Incorrect handling may cause the equipment to operate improperly, its life to be reduced considerably, and in the worst case, the converter and inverter to be damaged. Please handle the unit properly in accordance with the information on each section as well as the precautions and instructions of this manual.

1.1.1 Features of FR-HC2 (high power factor converter)

Power supply harmonics generated from the converter part of an inverter may affect devices including a dynamo and a static capacitor. Power supply harmonics differ from noise and leakage current in their generating source, frequency range and transmission method. Power supply harmonic may be suppressed by using this converter, allowing the compliance with the harmonic suppression guideline issued by the former Japanese Ministry of International Trade and Industry (currently the Ministry of Economy, Trade and Industry). Conversion factor of the converter is K5=0 in the self-excitation three-phase bridge circuit.

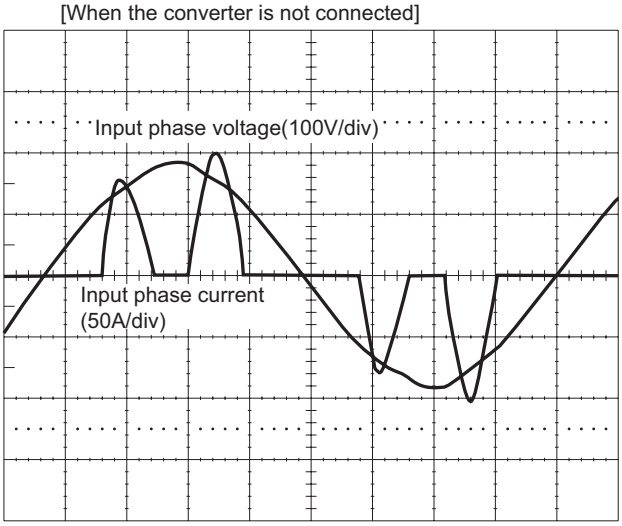
REMARKS

Set the following parameters to the inverter.
- *Pr. 30 Regenerative function selection* ="2"
- *Pr. 19 Base frequency voltage* (under V/F control), *Pr. 83 Rated motor voltage* (under control methods other than V/F control) = "Rated motor voltage"

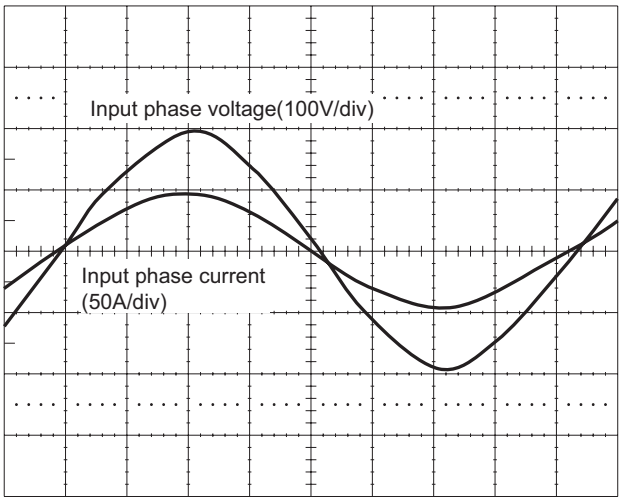
●Power supply harmonic suppression effect

(Example) FR-HC2-7.5K
(Condition) Load: 100%
Power factor: 1

[When the converter is not connected]



[When the converter is connected]



NOTE

- **When the load is light, harmonic suppression effect declines.**
- **When the power supply voltage is unstable, harmonics from electric power system flow in, making the harmonic current larger.**

1.1.2 Japanese harmonic suppression guideline

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The harmonic suppression guideline was established to protect other consumers from these outgoing harmonics.
The all capacities and all models of the inverters used by the specific consumers became subject to the harmonic suppression guideline for the consumers who receive high-voltage or special high-voltage (hereafter referred to as "Harmonic suppression guideline for specific consumers").

[Harmonic suppression guideline for specific consumers]

This guideline sets the maximum values of outgoing harmonic currents generated from a high-voltage or specially high-voltage consumer who will install, add or renew harmonic generating equipment. If any of the maximum values are exceeded, this guideline requires the consumer to take certain suppression measures.

Table 1 Maximum outgoing harmonic current per 1kW contract

Received Power Voltage	5th	7th	11th	13th	17th	19th	23rd	Over 23rd
6.6kV	3.5	2.5	1.6	1.3	1.0	0.9	0.76	0.70
22kV	1.8	1.3	0.82	0.69	0.53	0.47	0.39	0.36
33kV	1.2	0.86	0.55	0.46	0.35	0.32	0.26	0.24

(1) Application of the harmonic suppression guideline for specific consumers

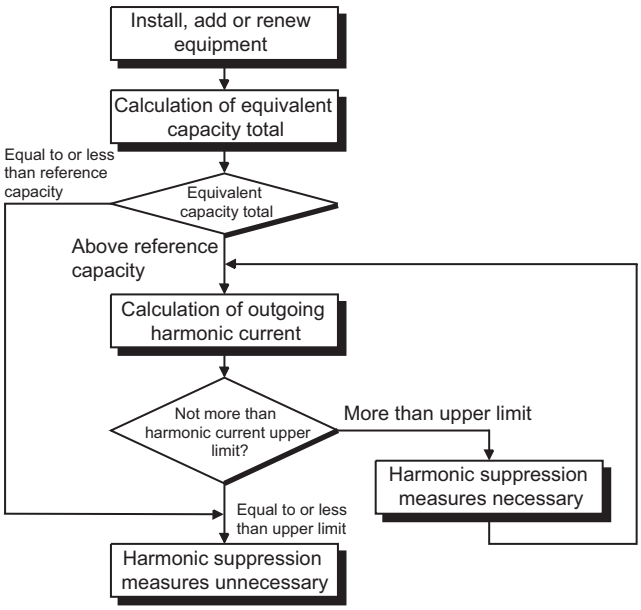

Install, add or renew equipment
Calculation of equivalent capacity total
Equal to or less than reference capacity
Equivalent capacity total
Above reference capacity
Calculation of outgoing harmonic current
Not more than harmonic current upper limit?
More than upper limit
Harmonic suppression measures necessary
Equal to or less than upper limit
Harmonic suppression measures unnecessary

Table 2 Conversion Factors for FR-A700 Series

Classification	Circuit Type		Conversion Factor Ki
3	Three-phase bridge (Capacitor smoothed)	Without a reactor	K31=3.4
		With a reactor (on AC side)	K32=1.8
		With a reactor (on DC side)	K33=1.8
		Without a reactor (on AC/DC side)	K34=1.4
5	Self-excitation three-phase bridge	With the converter	K5=0

Table 3 Equivalent Capacity Limits

Received Power Voltage	Reference Capacity
6.6kV	50kVA
22/33kV	300kVA
66kV or more	2000kVA

Table 4 Harmonic Content (Values at the fundamental current of 100%)

Reactor	5th	7th	11th	13th	17th	19th	23rd	25th
Not used	65	41	8.5	7.7	4.3	3.1	2.6	1.8
Used (AC side)	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
Used (DC side)	30	13	8.4	5.0	4.7	3.2	3.0	2.2
Used (on AC/DC side)	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

(a) Calculation of equivalent capacity P0 of harmonic generating equipment

The "equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of a consumer's harmonic generating equipment and is calculated with the following equation. When the sum of equivalent capacity exceeds the limits in Table 3, harmonics must be calculated in the following procedure.

$P0 = \Sigma (Ki \times Pi)$ [kVA]

Ki: Conversion factor(According to Table 2)

Pi: Rated capacity of harmonic generating equipment* [kVA]

i : Number indicating the conversion circuit type

* Rated capacity: Rated capacity is determined by the capacity of the applied motor and found in Table 5. It should be noted that the rated capacity used here is used to calculate generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

(b) Calculation of outgoing harmonic current

Outgoing harmonic current=fundamental wave current (value converted from received power voltage) × operation ratio × harmonic content

•Operation ratio: Operation ratio = actual load factor × operation time ratio during 30 minutes

•Harmonic content: Found in Table 4.

Table 5 Rated Capacity and Outgoing Harmonic Current during Inverter Run

Applied Motor (kW)	Rated Current [A]		Fundamental Wave Current Converted from 6.6kV (mA)	Rated Capacity (kVA)	Harmonic Current Converted from 6.6kV (mA) (No reactor, 100% operation ratio)							
	200V	400V			5th	7th	11th	13th	17th	19th	23rd	25th
0.4	1.61	0.81	49	0.57	31.85	20.09	4.165	3.773	2.107	1.519	1.274	0.882
0.75	2.74	1.37	83	0.97	53.95	34.03	7.055	6.391	3.569	2.573	2.158	1.494
1.5	5.50	2.75	167	1.95	108.6	68.47	14.20	12.86	7.181	5.177	4.342	3.006
2.2	7.93	3.96	240	2.81	156.0	98.40	20.40	18.48	10.32	7.440	6.240	4.320
3.7	13.0	6.50	394	4.61	257.1	161.5	33.49	30.34	16.94	12.21	10.24	7.092
5.5	19.1	9.55	579	6.77	376.1	237.4	49.22	44.58	24.90	17.95	15.05	10.42
7.5	25.6	12.8	776	9.07	504.4	318.2	65.96	59.75	33.37	24.06	20.18	13.97
11	36.9	18.5	1121	13.1	728.7	459.6	95.29	86.32	48.20	34.75	29.15	20.18
15	49.8	24.9	1509	17.6	980.9	618.7	128.3	116.2	64.89	46.78	39.24	27.16
18.5	61.4	30.7	1860	21.8	1209	762.6	158.1	143.2	79.98	57.66	48.36	33.48
22	73.1	36.6	2220	25.9	1443	910.2	188.7	170.9	95.46	68.82	57.72	39.96
30	98.0	49.0	2970	34.7	1931	1218	252.5	228.7	127.7	92.07	77.22	53.46
37	121	60.4	3660	42.8	2379	1501	311.1	281.8	157.4	113.5	95.16	65.88
45	147	73.5	4450	52.1	2893	1825	378.3	342.7	191.4	138.0	115.7	80.10
55	180	89.9	5450	63.7	3543	2235	463.3	419.7	234.4	169.0	141.7	98.10

Applied Motor (kW)	Rated Current [A]		Fundamental Wave Current Converted from 6.6kV (mA)	Rated Capacity (kVA)	Harmonic Current Converted from 6.6kV (mA) (With a DC reactor, 100% operation ratio)							
	200V	400V			5th	7th	11th	13th	17th	19th	23rd	25th
75	245	123	7455	87.2	2237	969	626	373	350	239	224	164
90	293	147	8909	104	2673	1158	748	445	419	285	267	196
110	357	179	10848	127	3254	1410	911	542	510	347	325	239
132	—	216	13091	153	3927	1702	1100	655	615	419	393	288
160	—	258	15636	183	4691	2033	1313	782	735	500	469	344
220	—	355	21515	252	6455	2797	1807	1076	1011	688	645	473
250	—	403	24424	286	7327	3175	2052	1221	1148	782	733	537
280	—	450	27273	319	8182	3545	2291	1364	1282	873	818	600
315	—	506	30667	359	9200	3987	2576	1533	1441	981	920	675
355	—	571	34606	405	10382	4499	2907	1730	1627	1107	1038	761
400	—	643	38970	456	11691	5066	3274	1949	1832	1247	1169	857
450	—	723	43818	512	13146	5696	3681	2191	2060	1402	1315	964
500	—	804	48727	570	14618	6335	4093	2436	2290	1559	1462	1072
560	—	900	54545	638	16364	7091	4582	2727	2564	1746	1636	1200

(c)Deciding whether to take harmonic suppression measures

When the outgoing harmonic current > the maximum value per 1kW contract × contract kW, a harmonic suppression measures are required.

(d) Harmonic suppression measures

No.	Item	Description
1	Reactor (FR-HAL, FR-HEL)	Harmonic current is suppressed by installing an AC reactor (FR-HAL) in the AC input side of the inverter or a DC reactor (FR-HEL) in the DC bus line of the inverter, or by installing both.
2	High power factor converter (FR-HC2)	FR-HC2 is designed to switch ON/OFF the converter circuit to convert an input current waveform into a sine wave, suppressing the harmonic current considerably. The converter (FR-HC2) is used with the standard-equipped peripheral devices and accessories.
3	Power factor improving static capacitor	Using the power factor improving static capacitor with a series reactor has an effect of absorbing harmonic currents.
4	Multi-phase operation with transformers	Using two transformers with a phase angle difference of 30° as in 人 - △ and △ - △ combinations provides an effect corresponding to 12 pulses and reduces low-degree harmonic currents.
5	Passive filter (AC filter)	A capacitor and a reactor are used together to reduce impedance at specific frequencies, producing a great effect of absorbing harmonic currents.
6	Active filter	This filter detects the current of the circuit, where harmonic current is generated, and generates the harmonic current equivalent to the difference between that current and a fundamental wave current. By doing so, the harmonic current at where it was detected can be suppressed, and great absorption of harmonic current can be expected.

1.1.3 Product checking and parts identification

Unpack the product and check the capacity plate on the front cover and the rating plate on the side to ensure that the model and rated output agree with your order and the product is intact.

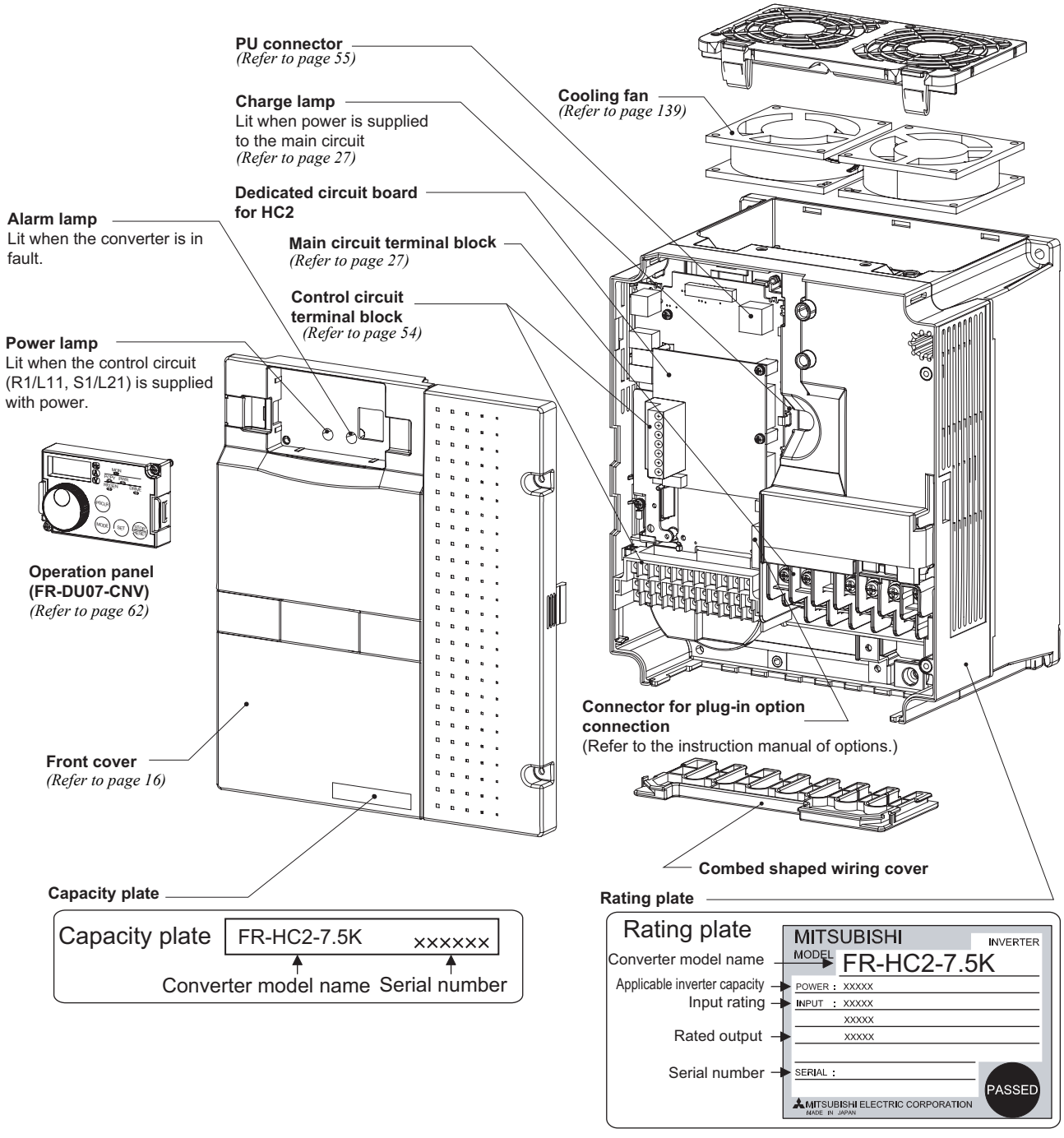
When combined with a Mitsubishi general-purpose inverter and other converter accessories, this converter suppresses harmonics according to the harmonic suppression guideline of the former Japanese Ministry of International Trade and Industry (currently the Ministry of Economy, Trade and Industry). Carefully check the specifications including the applicable capacities.

- High power factor converter model

FR-HC2- [ ] [7.5] K

Symbol	Voltage class
Not used	200V class
H	400V class

Converter capacity
Represents the inverter capacity [kW]



● **Checking peripheral devices**

• **Peripheral devices**

Always install the included peripheral devices. Check the model name of the each peripheral device.
For the 400V class peripheral devices, H is indicated in front of the model name.

FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K

Peripheral Device Model Name	Description	Quantity
FR-HC2-(H)□K	High power factor converter	1
FR-HCL21-(H)□K	Filter reactor 1	1
FR-HCL22-(H)□K	Filter reactor 2	1
FR-HCB2-(H)□K	Outside box *	1

* Terminal screws are enclosed for 7.5K and 15K. (M5 × 6)

FR-HC2-H280K, H560K

Peripheral Device Model Name	Model Name of Consisting Parts	Description	Quantity	
			280K	560K
FR-HC2-H□K	FR-HC2-H□K	High power factor converter	1	1
FR-HCL21-H□K	FR-HCL21-H□K	Filter reactor 1	1	1
FR-HCL22-H□K	FR-HCL22-H□K	Filter reactor 2	1	1
FR-HCC2-H□K	FR-HCC2-H□K	Filter capacitor	1	3
	MDA-1	filter capacitor alarm detector	—	3
FR-HCR2-H□K	0.96OHM BKO-CA1996H21	Inrush current limit resistor (without thermostat)	8	15
	0.96OHM BKO-CA1996H31	Inrush current limit resistor (with thermostat)	1	3
FR-HCM2-H□K	1PH 630VA BKO-CA2001H06	Stepdown transformer for power source of MCs (400V-200V)	1	1
	S-N400FXYS AC200V 2A2B	Inrush current limit MC	—	3
	S-N600FXYS AC200V 2A2B	Inrush current limit MC	1	—
	SR-N4FX AC210V 4A	Buffer relay	1	2
	TS-807B-5P	Terminal block	6	—
	C152C481H21	Terminal block shorting conductor	6	—
	C152C423H21	MC shorting conductor	—	6
	MYQ4Z AC200/220	Mini relay for filter capacitor alarm detector	—	1
	PYF14T	Mini relay terminal block	—	1
	PYC-A1	Mini relay clip	—	2
	M12×50 ZENNEJI	MC shorting conductor bolt (M12 × 50)	—	24
	M12	MC shorting conductor nut (M12)	—	24
	MIGAKI 12	MC shorting conductor washer (flat washer)	—	48
	BANE 12	MC shorting conductor washer (spring washer)	—	24
	SW-PW-P-NA M5 × 12	Inrush current limit resistor screw (M5 × 12)	—	54

• **Eyebolt for hanging the converter (30K to 75K (200V class), 75K, 110K and 280K (400V class))**

	Capacity	Eyebolt Size	Quantity
200V	30K, 55K	M8	2
	75K	M10	2
400V	75K	M8	2
	110K	M10	2
	280K	M12	2

• **Instruction Manual**

If you have any inquiry, or if damage is found on the product, please contact your sales representative.

1.2 Converter and peripheral devices

Three-phase AC power supply
Use within the permissible power supply specifications of the converter.

Moulded case circuit breaker (MCCB) or earth leakage current breaker (ELB), fuse
The breaker must be selected carefully since an inrush current flows in the converter at power ON.

Magnetic contactor (MC)
Install the magnetic contactor to ensure safety.
Do not use this magnetic contactor to start and stop the high power factor converter and the inverter. Doing so will shorten the life of the inverter and the converter.

Reactor 1 (FR-HCL21)
Confirm that the capacity of the reactor is selected according to the capacity of the converter.
(Refer to page 33, 46)

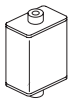
Outside box (FR-HCB2)*
Check that the capacity of the outside box matches with the capacity of the high power factor converter.
(Refer to page 31)
*Outside box is not available for 280K or higher. Connect filter capacitors, inrush current limit resistors, and magnetic contactors.

Reactor 2 (FR-HCL22)
Confirm that the capacity of the reactor is selected according to the capacity of the converter. *(Refer to page 33, 46)*

High power factor converter (FR-HC2)
Install and wire correctly.
Do not install the moulded case circuit breaker (MCCB) between terminals P and P, or N and N of the converter and the inverter.
(Refer to page 31, 44)

R4 S4 T4

P N

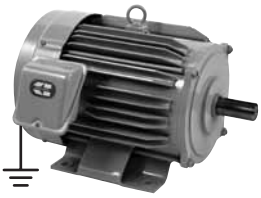


Fuse
Installation of a fuse is recommended for safety.
Select a fuse according to the connected motor capacity.
(Refer to page 11)

Inverter
Confirm that this is a FR-HC2 supporting inverter. (Refer to the inverter catalogs for compatible inverters.)
Connect an inverter that corresponds with the each capacity of the converter.
Match the control logic (sink logic / source logic) of the converter and the inverter. *(Refer to page 56)*

Devices connected to the output
Do not install a power factor correction capacitor, surge suppressor or radio noise filter on the output side of the inverter. When installing a moulded case circuit breaker on the output side of the inverter, contact each manufacturer for selection of the moulded case circuit breaker.

Earth (Ground)
To prevent an electric shock, always earth (ground) the motor and inverter.



Motor
Connect the motor corresponds to the each capacity.

Earth (Ground)

1.3 Precautions for selecting peripheral devices

1.3.1 Measures against noises (EMI)

In this section, noises indicate those of more than 40th to 50th high frequencies in a power distribution system, which generally assume irregular conditions.
Some noises enter the converter to adversely affect it, and others are radiated by the converter to adversely affect peripheral devices. Though the converter is designed to be immune to noises, it handles low-level signals, so it requires the following basic measures. Also, since the converter chops input voltage at high carrier frequency, it could generate noises. If these noises affect peripheral devices, measures should be taken to suppress noises (EMI measures). The EMI measures differ slightly depending on the noise transmission paths.

(1) Basic measures

- Do not place the power cables (I/O cables) and signal cables of the converter in parallel with each other and do not bundle them.
- For the control signal cable and the connection cable with a detector, use twisted pair shield cables, and connect the sheath of the shielded cables to the terminal SD.
- Ground (earth) the reactor 1, reactor 2, outside box, converter, inverter, motor, etc. at one point.

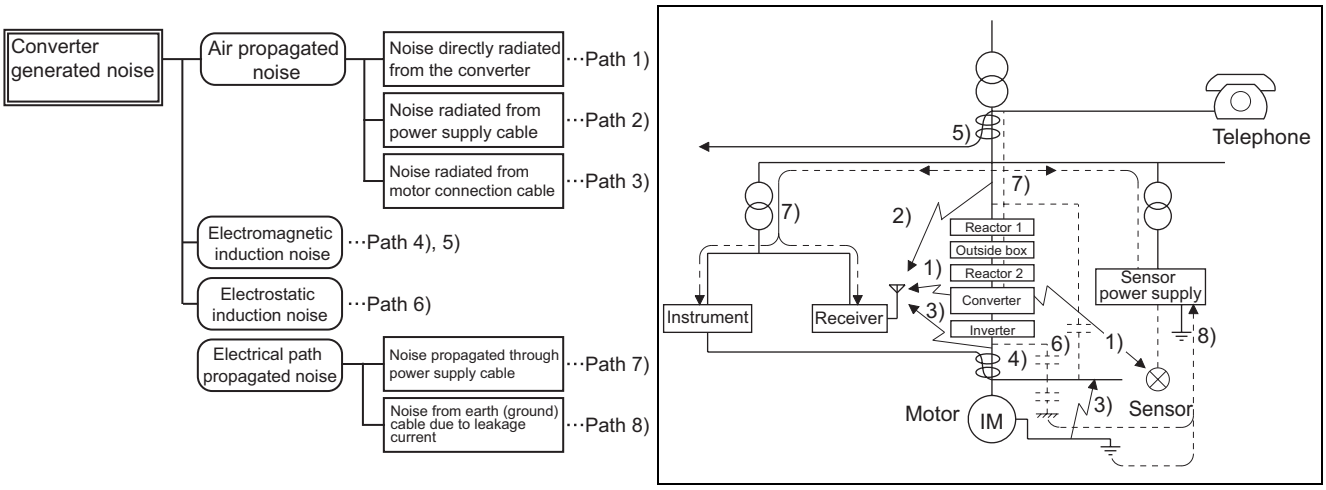
(2) Measures against noises which enter and affect the converter

When devices, which generate many noises, (for example, magnetic contactors, magnetic brakes, many relays) are installed near the converter, the converter may malfunction because of the noises. In that case, the following measures must be taken.

- Provide surge suppressors for the devices that generate many noises, and suppress the noises.
- Install data line filters to signal cables.
- Ground (earth) the connection cable with a detector and a control signal cable with a metal cable clamp.

(3) Measures against the noises that are radiated by the converter to affect peripheral devices

Noises radiated by the converter are largely classified into three types: those radiated by the cables connected to the converter and converter's main circuit (I/O), those electromagnetically and electrostatically inducted to the signal cables of the peripheral devices close to the main circuit cable, and those transmitted through the power supply cables.

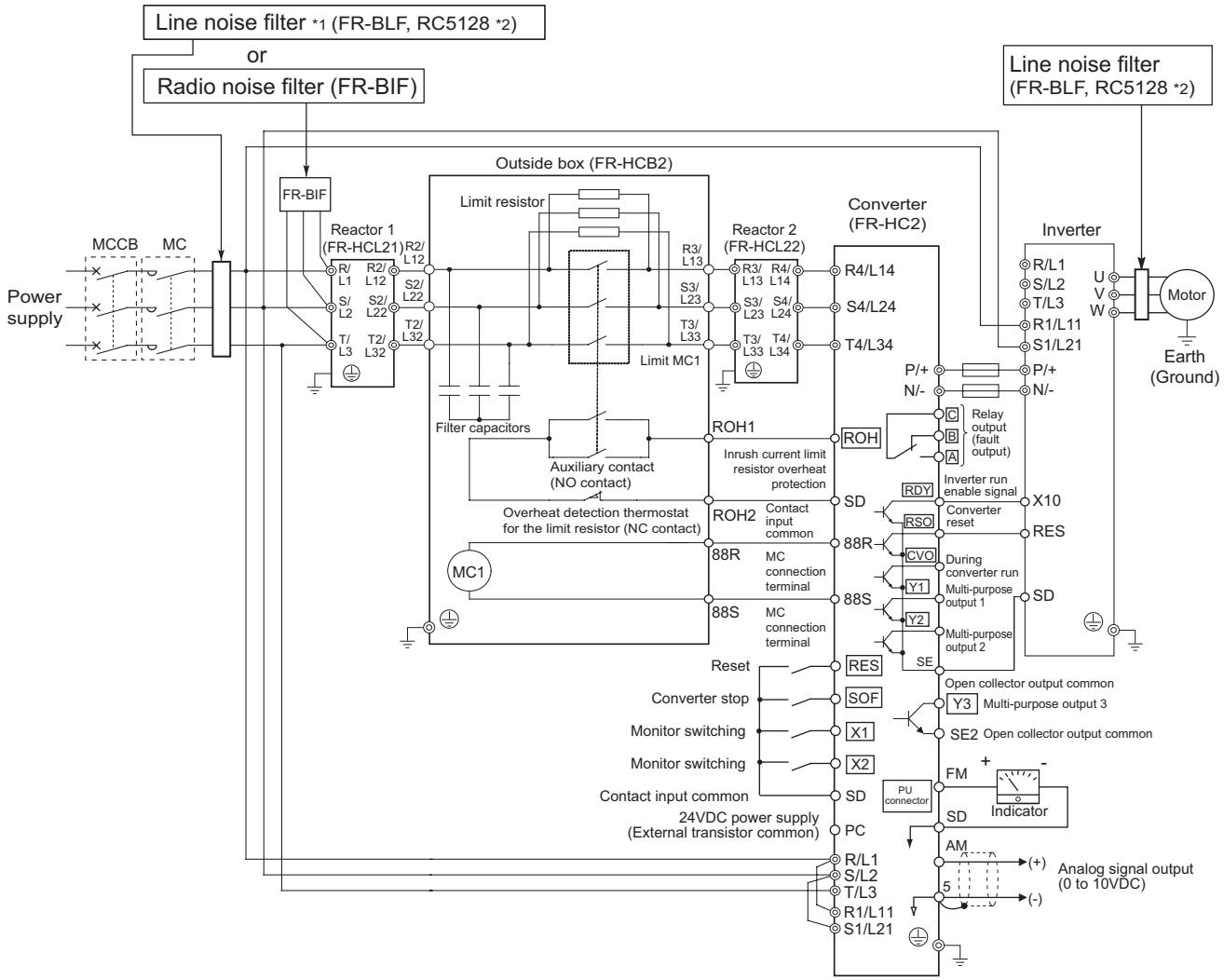


Noise Transmission Path	Measures
1) 2) 3)	When the devices, which handle low-level signals and are susceptible to noises (such as measuring instruments, receivers and sensors), are installed near or in the same enclosure with the converter, or their signal cables are placed near of in the same enclosure with the converter, air-transmitted noises may cause malfunction of the devices. In that cases, the following measures must be taken. (1) Install the easily affected devices as far away from the converter and inverter as possible. (2) Place the easily affected signal cables as far away from the converter and inverter as possible. (3) Do not place the signal cables and power cables (converter I/O cables) in parallel with each other and do not bundle them. (4)Insert line noise filters (FR-BLF, RC5128 (available product manufactured by Soshin Electric Co., Ltd.)) and radio noise filters (FR-BIF) into the input side of the converter, and insert line noise filters (FR-BLF, RC5128 (available product manufactured by Soshin Electric Co., Ltd.)) into the output side of the inverter to suppress cable-radiated noises. (5) Use shield cables for signal cables and power cables and place them in individual metal conduits to produce further effects.
4) 5) 6)	When the signal cables are placed in parallel with or bundled with the power cables, magnetic and static induction noises may be transmitted to the signal cables to cause malfunction of the devices. In that case, the following measures must be taken. (1) Install the easily affected devices as far away from the converter and inverter as possible. (2) Place the easily affected signal cables as far away from the converter, inverter, and their I/O cables as possible. (3) Do not place the signal cables and power cables (I/O cables of the converter and inverter) in parallel with each other and do not bundle them. (4) Use shield cables for signal cables and power cables and place them in individual metal conduits to produce further effects.
7)	When the peripheral devices are connected to the same power supply line with the converter, converter-generated noises may flow back through the power supply cable to the devices, causing malfunction of the devices. In that case, the following measures must be taken. (1) Install radio noise filters (FR-BIF) to the power cable (input cable) of the converter. (2) Install the line noise filters (FR-BLF, RC5128 (available product manufactured by Soshin Electric Co., Ltd.)) to the power cable (input cable) of the converter and to the power cable (output cable) of the inverter.
8)	When a closed loop circuit is configured by connecting the wiring of a peripheral device to the converter, leakage current may flow through the ground (earth) cable of the converter, causing malfunction of the device. In that case, disconnecting the ground (earth) cable of the device may remove the malfunction.

(4) Using options to suppress noises

By using the radio noise filter (FR-BIF) and the line noise filter (FR-BLF), the noise radiated from the connection cable can be suppressed. Refer to the Instruction Manual of each option for the detail of the radio noise filter (FR-BIF) and the line noise filter (FR-BLF).

●Example (FR-A700 series)



*1 Install the line noise filter to the terminal R, S, and T of the converter, but not to the power supply. Refer to the Instruction Manual of the noise filter for the installation procedure of the noise filter.

*2 Product available on the market ..... RC5128: manufactured by Soshin Electric Co., Ltd.

NOTE

- **Configure a system where the magnetic contactor at the converter input side shuts off the power supply at a failure of the converter or the connected inverter. (The converter does not shut off the power supply by itself.) Failure to do so may overheat and burn the resistors in the converter and the connected inverter.**

1.3.2 Peripheral device list

(1) Circuit breakers and magnetic contactors

Check the model of the converter and select peripheral devices according to the capacity. Refer to the table below to prepare appropriate peripheral devices.

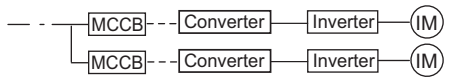
●200V class

Converter Model	Moulded Case Circuit Breaker (MCCB) *1 or Earth Leakage Circuit Breaker (ELB)*2 (NF, NV type)	Magnetic Contactor (MC)*3
FR-HC2-7.5K	50A	S-N25
FR-HC2-15K	75A	S-N50
FR-HC2-30K	150A	S-N80
FR-HC2-55K	300A	S-N180
FR-HC2-75K	350A	S-N300

●400V class

Converter Model	Moulded Case Circuit Breaker (MCCB) *1 or Earth Leakage Circuit Breaker (ELB)*2 (NF, NV type)	Magnetic Contactor (MC)*3
FR-HC2-H75K	175A	S-N95
FR-HC2-H110K	250A	S-N180
FR-HC2-H280K	700A	S-N600
FR-HC2-H560K	1500A	S-N400 (three in parallel)

*1 •Select an MCCB according to the power supply capacity.
•Install one MCCB per converter.



*2 For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse that is suitable for branch circuit protection. *(Refer to page 177)*

*3 Magnetic contactor is selected based on the AC-1 class.The electrical durability of magnetic contactor is 100,000 times.When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.
When using the MC for emergency stop during motor driving or using on the motor side during commercial-power supply operation, select the MC with class AC-3 rated current for the motor rated current.

NOTE

• When the MCCB on the converter input side trips, check for the wiring fault (short circuit), damage to internal parts of the converter, etc. Identify the cause of the trip, then remove the cause and power ON the breaker.

(2) Fuse

Installation of a fuse is recommended between a high power factor converter and an inverter.
Select a fuse according to the capacity of the connected motor. When using a motor, of which the capacity is smaller than the inverter capacity by two ranks or more, select the fuse with the capacity that is one rank lower than the inverter capacity. (*Refer to page 35 and 48 for details.*)

[Fuse selection table]

●200V class

Motor capacity (kW)	Recommended fuse		
	Fuse rating (A)	Model	Fuse holder (2 poles)
0.1	5	6.900 CP GR 10.38 0005	US102 (without fuse light melting indicator) or US102I (with fuse light melting indicator)
0.2	10	6.900 CP GR 10.38 0010	
0.4	16	6.900 CP GR 10.38 0016	
0.75	20	6.900 CP GR 10.38 0020	
1.5	25	6.900 CP GR 10.38 0025	
2.2	50	6.9 URD 30 TTF 0050	—
3.7	63	6.9 URD 30 TTF 0063	—
5.5	100	6.9 URD 30 TTF 0100	—
7.5	125	6.9 URD 30 TTF 0125	—
11	160	6.9 URD 30 TTF 0160	—
15	200	6.9 URD 30 TTF 0200	—
18.5	250	6.9 URD 30 TTF 0250	—
22	315	6.9 URD 30 TTF 0315	—
30	400	6.9 URD 30 TTF 0400	—
37	500	6.9 URD 30 TTF 0500	—
45	630	6.9 URD 31 TTF 0630	—
55	700	6.9 URD 31 TTF 0700	—
75	800	6.9 URD 31 TTF 0800	—

* Manufacturer: Mersen Japan K.K.
Contact: Sun-Wa Technos Corporation

●400V class

Motor capacity (kW)	Recommended fuse		
	Fuse rating (A)	Model	Fuse holder (2 poles)
0.4	12.5	6.900 CP GR 10.38 0012	US102 (without fuse light melting indicator) or US102I (with fuse light melting indicator)
0.75	16	6.900 CP GR 10.38 0016	
1.5	16	6.900 CP GR 10.38 0016	
2.2	20	6.900 CP GR 10.38 0020	
3.7	30	6.900 CP GR 10.38 0030	
5.5	50	6.9 URD 30 TTF 0050	—
7.5	50	6.9 URD 30 TTF 0050	—
11	80	6.9 URD 30 TTF 0080	—
15	125	6.9 URD 30 TTF 0125	—
18.5	125	6.9 URD 30 TTF 0125	—
22	160	6.9 URD 30 TTF 0160	—
30	200	6.9 URD 30 TTF 0200	—
37	250	6.9 URD 30 TTF 0250	—
45	315	6.9 URD 30 TTF 0315	—
55	350	6.9 URD 30 TTF 0350	—
75	450	6.9 URD 30 TTF 0450	—
90	500	6.9 URD 30 TTF 0500	—
110	550	6.9 URD 31 TTF 0550	—
132	630	6.9 URD 31 TTF 0630	—
160	800	6.9 URD 31 TTF 0800	—
185	900	6.9 URD 32 TTF 0900	—
220	1000	6.9 URD 32 TTF 1000 or 6.9 URD 31 TTF 0630 × 2 in parallel	—
250	1250	6.9 URD 33 TTF 1250 or 6.9 URD 31 TTF 0700 × 2 in parallel	—
280	1400	6.9 URD 33 TTF 1400 or 6.9 URD 31 TTF 0800 × 2 in parallel	—
315	1600	6.9 URD 232 TTF 1600 or 6.9 URD 31 TTF 0800 × 2 in parallel	—
355	1800	6.9 URD 232 TTF 1800 or 6.9 URD 32 TTF 0900 × 2 in parallel	—
400	1800	6.9 URD 232 TTF 1800 or 6.9 URD 32 TTF 0900 × 2 in parallel	—
450	2500	6.9 URD 33 TTF 1250 × 2 in parallel	—
500	2700	6.9 URD 32 TTF 0900 × 3 in parallel	—
560	2700	6.9 URD 32 TTF 0900 × 3 in parallel	—

* Manufacturer: Mersen Japan K.K.
Contact: Sun-Wa Technos Corporation

NOTE

- **Install a fuse across terminal P/+ of the inverter and the converter and across terminal N/- of the inverter and the converter.**

[Estimated lifespan of fuse]

Part Name	Estimated lifespan*	Replacement method
Fuse	10 years	Replace with a new one

* Estimated lifespan for when the yearly average surrounding air temperature is 50°C (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)

NOTE

- **If the fuse melts down, wiring failure such as a short circuit may be the cause. Identify the problem and fix it before replacing the fuse.**

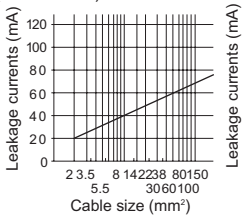
1.3.3 Selecting the rated sensitivity current for the earth leakage circuit breaker

When using the earth leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows.

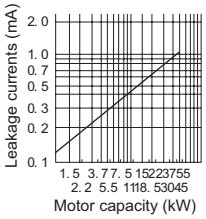
- Breaker for harmonic and surge
  Rated sensitivity current $I\Delta n \geq 10 \times (Ig1+Ign+Ig2+Ig3+Igm)$
- Standard breaker
  Rated sensitivity current $I\Delta n \geq 10 \times \{Ig1+Ign+Ig2+3\times(Ig3+Igm)\}$

Ig1, Ig2, Ig3 : leakage current of cable path during commercial power supply operation
Ign : leakage current of noise filter on the converter input side
Igm : leakage currents of motor during commercial power supply operation

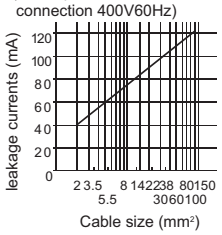
Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)



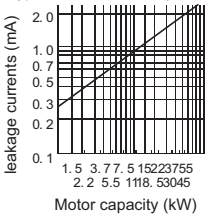
Leakage current example of three-phase induction motor during the commercial power supply operation (200V 60Hz)



Example of leakage current per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (Three-phase three-wire delta connection 400V60Hz)

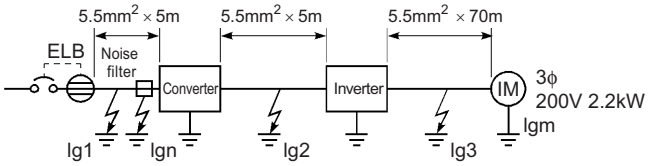


Leakage current example of three-phase induction motor during the commercial power supply operation (Totally-enclosed fan-cooled type motor 400V60Hz)



For "人" connection, the amount of leakage current is appox.1/3 of the above value.

<Example>



Selection Example
(for the diagram shown on the left) (mA)

	Breaker for harmonic and surge	Standard breaker
Leakage current Ig1 (mA)	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current Ign (mA)	0 (without noise filter)	
Leakage current Ig2 (mA)	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current Ig3 (mA)	$33 \times \frac{70m}{1000m} = 2.31$	
Leakage current Igm (mA)	0.18	
Total leakage current (mA)	2.83	7.81
Rated sensitivity current (≥Ig×10)(mA)	30	100

NOTE

- **Install the earth leakage circuit breaker (ELB) on the input side of the converter.**
- **In the 人 connection earthed-neutral system, the sensitivity current is blunt against an earth (ground) fault in the inverter output side. Earthing (Grounding) must conform with the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards)**
- **When the breaker is installed on the output side of the inverter, it may be unnecessarily operated by harmonics even if the effective value is less than the rating.**
  In this case, do not install the breaker since the eddy current and hysteresis loss will increase, leading to temperature rise.
- **The following models are the standard breakers….BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA, NV-2F earth leakage relay (except NV-ZHA), NV with AA neutral wire open-phase protection**
  The other models are designed for harmonic and surge suppression….NV-C/NV-S/MN series, NV30-FA, NV50-FA, BV-C2, earth leakage alarm breaker (NF-Z), NV-ZHA, NV-H

MEMO

2 INSTALLATION AND WIRING

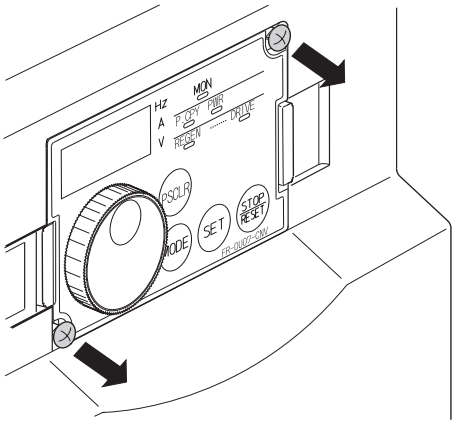
This chapter provides an "INSTALLATION AND WIRING" of this product.
Always read the instructions before using the equipment.

2.1 Removal and installation of the converter (FR-HC2) front cover 16
2.2 Removal and installation of the outside box (FR-HCB2) front cover 18
2.3 Installation 19
2.4 Protruding the heatsink 21
2.5 Installation of peripheral devices 23
2.6 Main circuit terminal specifications 27
2.7 Wiring of main circuit (FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K) 31
2.8 Wiring of main circuit (FR-HC2-H280K) 38
2.9 Wiring of main circuit (FR-HC2-H560K) 44
2.10 Notes on earthing (grounding) 50
2.11 Compatible inverter for the high power factor converter 51
2.12 Wiring of several inverters to one converter 52
2.13 Wiring of control circuit 54

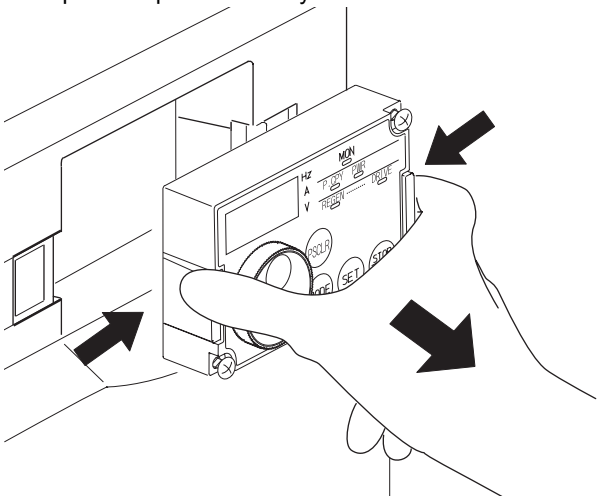
2.1 Removal and installation of the converter (FR-HC2) front cover

●Removal of the operation panel

1) Loosen the two fixed screws on the operation panel. (These screws cannot be removed.)



2) Push the left and right hooks of the operation panel and pull the operation panel toward you to remove.

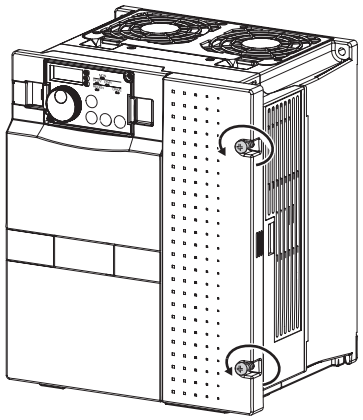


When reinstalling the operation panel, insert it straight to reinstall securely and tighten the screws of the operation panel.

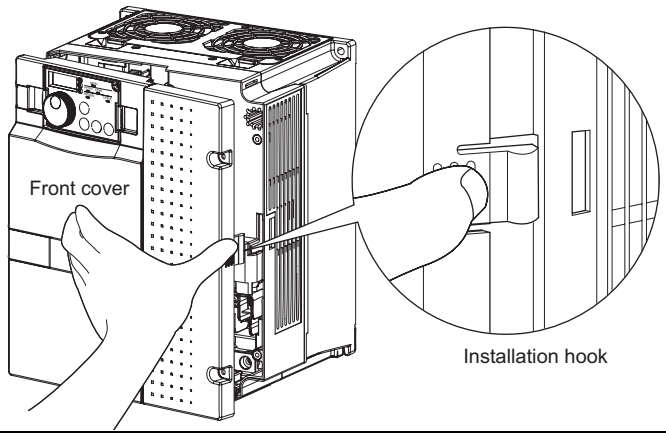
15K or lower

●Removal

1)Loosen the installation screws of the front cover.



2)Pull the front cover toward you to remove by pushing an installation hook using left fixed hooks as supports.

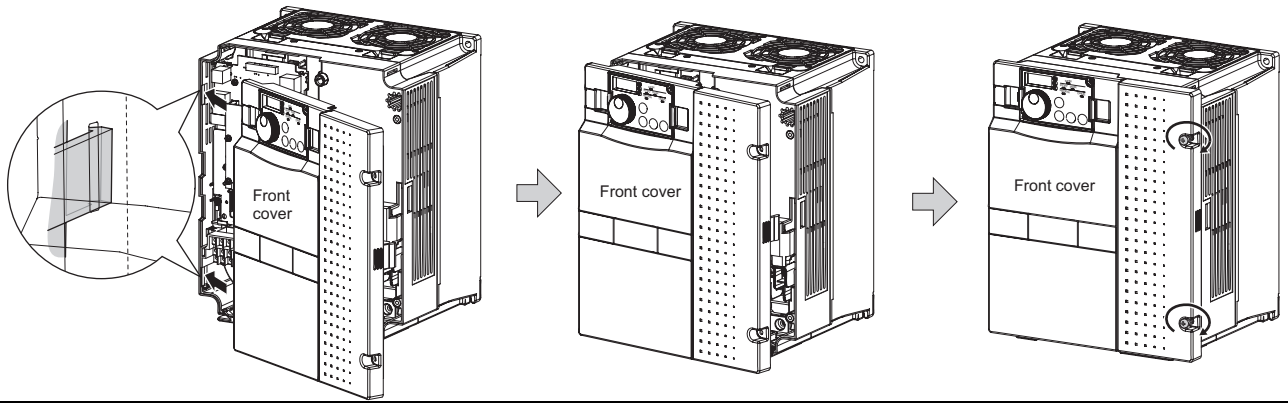


●Reinstallation

1) Insert the two fixed hooks on the left side of the front cover into the sockets of the inverter.

2) Using the fixed hooks as supports, securely press the front cover against the inverter. (Although installation can be done with the operation panel mounted, make sure that a connector is securely fixed.)

3) Tighten the installation screws and fix the front cover.



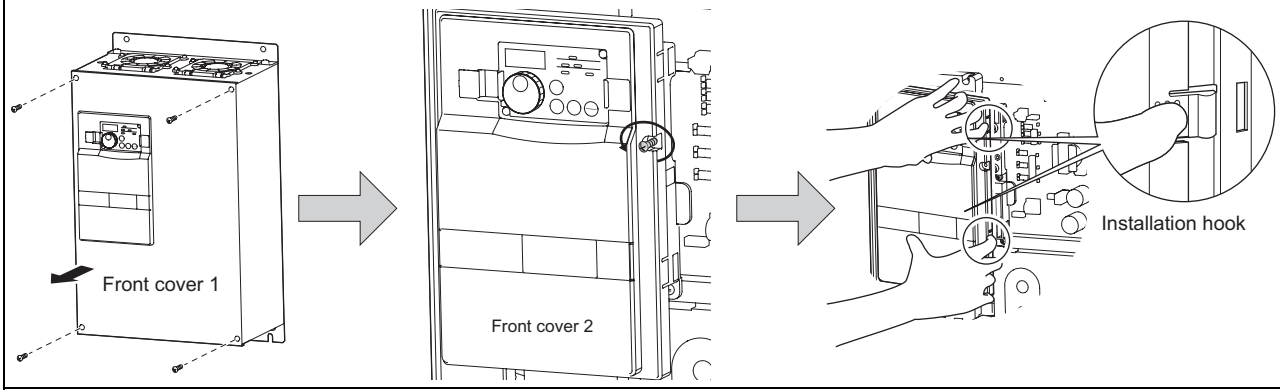
30K or higher

●Removal

1) Loosen the installation screws of the front cover 1, and remove the front cover 1.

2) Loosen the installation screw of the front cover 2.

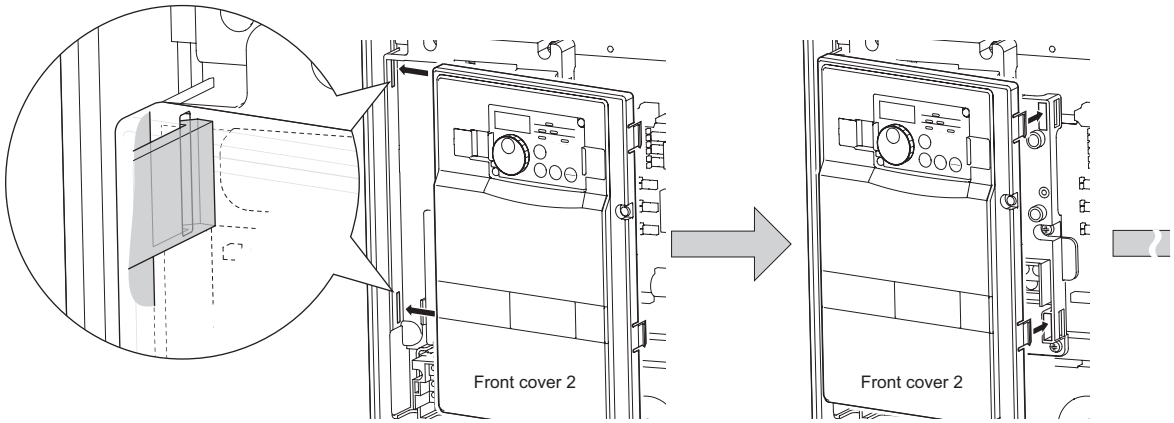
3) Push the two installation hooks on the right to remove, and pull the front cover toward you using the left fixed hooks as supports.



●Reinstallation

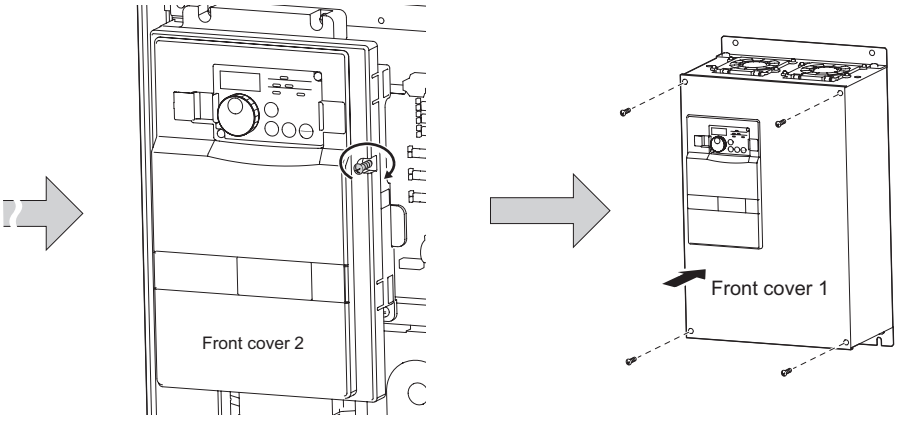
1) Insert the two fixed hooks on the left side of the front cover 2 into the sockets of the body.

2) Using the fixed hooks as supports, securely press the front cover 2 against the body.
(Although installation can be done with the operation panel mounted, make sure that a connector is securely fixed.)



3) Tighten the installation screw of the front cover 2.

4) Fit the front cover 1 and fix it with the installation screws.



REMARKS

- For the 280K or higher, the front cover 1 is separated into two parts.

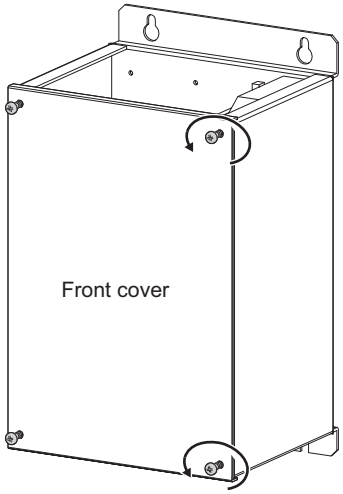
NOTE

- **Fully make sure that the front cover has been reinstalled securely. Always tighten the installation screws of the front cover.**
- **The same serial number is printed on the capacity plate of the front cover and the rating plate of the converter. Before reinstalling the front cover, check the serial numbers to ensure that the cover removed is reinstalled to the converter from where it was removed.**

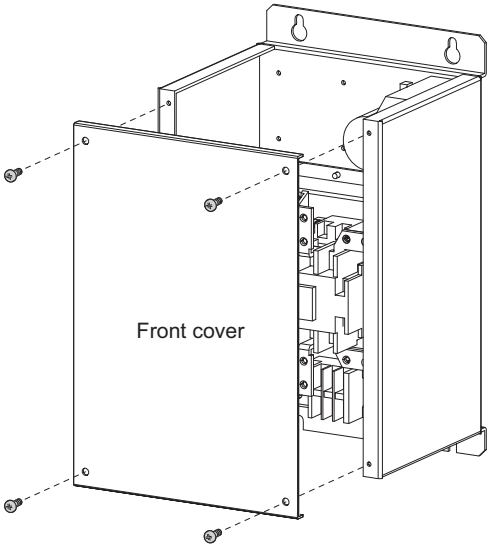
2.2 Removal and installation of the outside box (FR-HCB2) front cover

●Removal

1) Loosen the installation screws of the front cover.

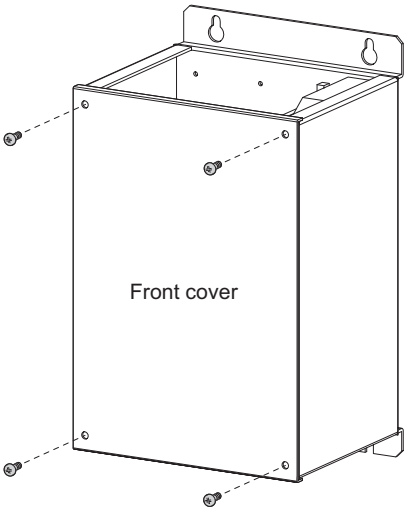


2) For removal, pull off the front cover.

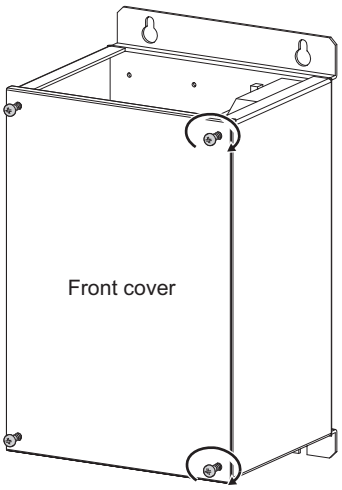


●Reinstallation

1) Securely press the front cover against the outside box.



2) Tighten the installation screws and fix the front cover.



NOTE

- **Fully make sure that the front cover has been reinstalled securely. Always tighten the installation screws of the front cover.**
- **The same serial number is printed on the capacity plate of the front cover and the rating plate of the outside box. Before reinstalling the front cover, check the serial numbers to ensure that the cover removed is reinstalled to the outside box from where it was removed.**

2.3 Installation

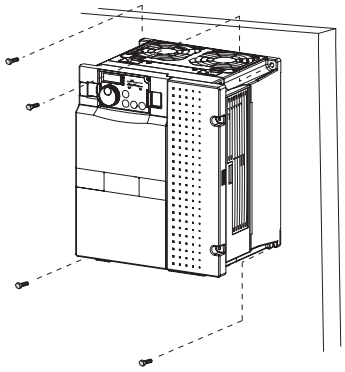
Incorrect installation and connection may cause the equipment to operate improperly and its lifespan to be reduced considerably. Please handle the unit properly in accordance with the information on each section as well as the precautions in this manual.

2.3.1 Converter placement

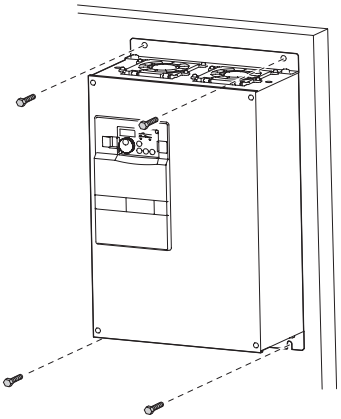
(1) Installation of the converter

Installation on the enclosure

7.5K, 15K



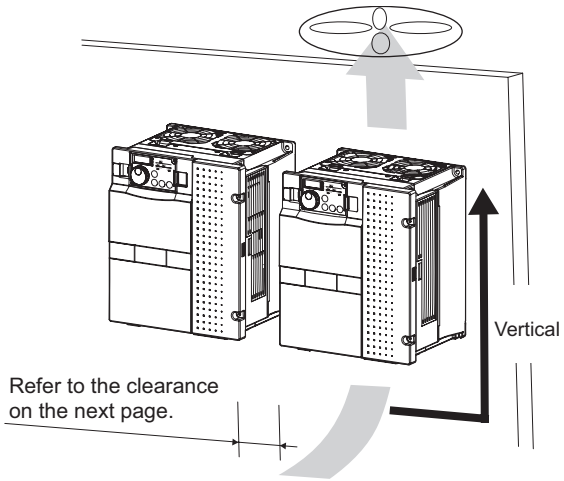
30K or higher



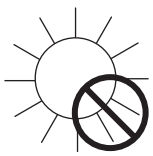
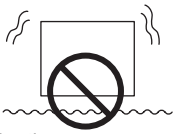
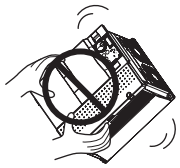
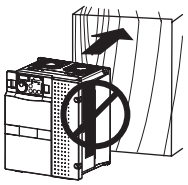
Fix six points for H280K, and eight points for H560K.

NOTE

- **When encasing multiple converters, install them in parallel as a cooling measure.**
- **Install the converter vertically.**

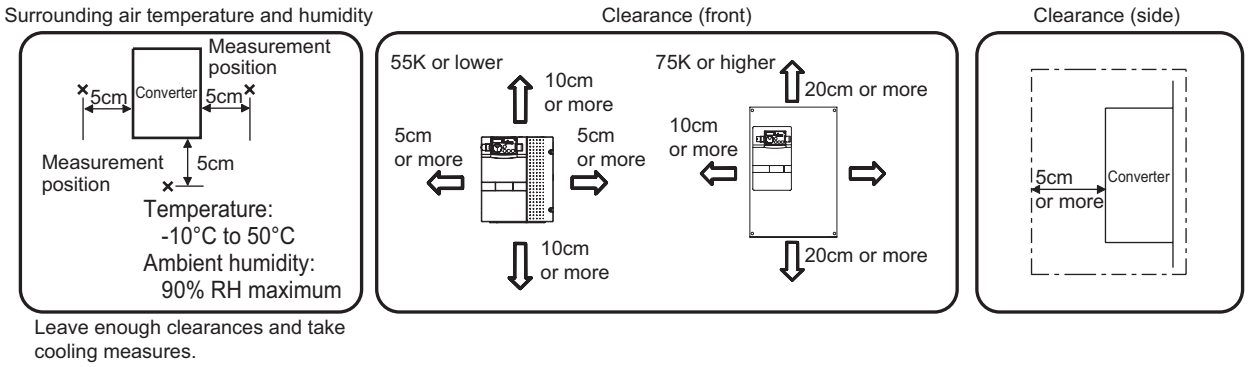


- The converter consists of precision mechanical and electronic parts. Never install or handle it in any of the following conditions as doing so could cause an operation fault or failure.

 Direct sunlight	 Vibration (5.9m/s^2 or more* at 10 to 55Hz (directions of X, Y, Z axes)) * 2.9m/s^2 or more for the 280K or higher	High temperature, high humidity	Horizontal placement
Vertical mounting (When installing two or more converters, install them in parallel.)	 Transportation by holding the front cover	Oil mist, flammable gas, corrosive gas, fluff, dust, etc.	 Mounting to combustible material

(2) Clearances around the converter

To ensure ease of heat radiation and maintenance, leave at least the shown clearance around the converter. At least the following clearance are required under the converter as a wiring space, and above the converter as a heat radiation space.



Leave enough clearances and take cooling measures.

REMARKS

For replacing the cooling fan of the 280K or higher, 30cm of space is necessary in front of the inverter. Refer to page *139* for fan replacement.

(3) Converter mounting orientation

Mount the converter on a wall as specified. Do not mount it horizontally or any other way.

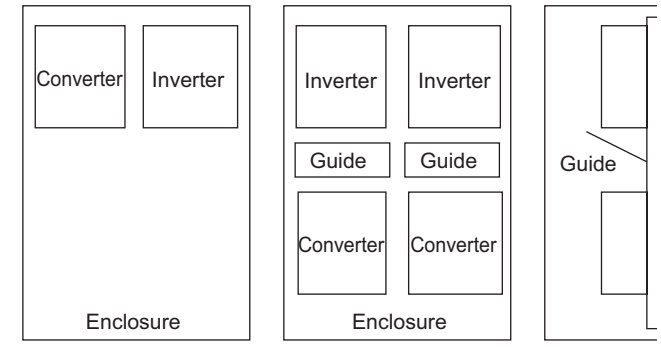
(4) Above the converter

Heat is blown up from inside the converter by the small fan built in the unit. Any equipment placed above the converter should be heat resistant.

(5) Arrangement of multiple inverters and converters

When installing multiple inverters and converters in the same enclosure, generally arrange them horizontally as shown in the right figure (a). When it is inevitable to arrange them vertically to minimize space, take such measures as to provide guides since heat from the bottom converters can increase the temperatures in the top inverters, causing inverter failures.

When installing multiple inverters and converters, full caution must be taken not to let the surrounding air temperature of the converters and inverters exceed the permissible value. Avoid the temperature to exceed the value by providing ventilation and increasing the enclosure size, etc.

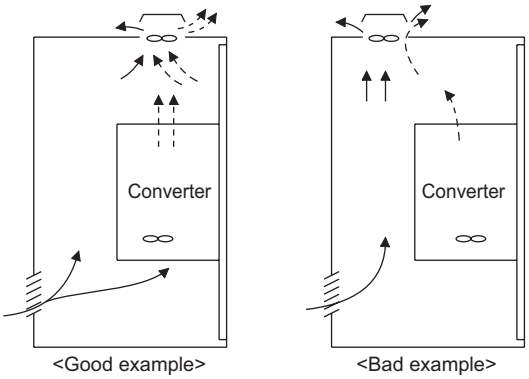


(a) Horizontal arrangement (b) Vertical arrangement

Arrangement of multiple inverters and converters

(6) Placement of ventilation fan and converter

Heat generated in the converter is blown up from the bottom of the unit as warm air by the cooling fan. When installing a ventilation fan for that heat, determine the place of ventilation fan installation after fully considering an air flow. (Air passes through areas of low resistance. Make an airway and airflow plates to expose the converter to cool air.)



Placement of ventilation fan and converter

2.4 Protruding the heatsink

When installing a converter inside an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heatsink of the converter.
This installation method is recommended when downsizing the enclosure and such.

2.4.1 When using a heatsink protrusion attachment (FR-A7CN)

For the FR-HC2-7.5K to 75K and FR-HC2-H110K, a heatsink can be protruded outside the enclosure using a heatsink protrusion attachment (FR-A7CN). (For the 280K or higher, the attachment is not necessary when the heatsink is to be protruded.)
Refer to the table below for the applicable heatsink protrusion attachments.
For a panel cut dimension drawing and an installation procedure of the heatsink protrusion attachment (FR-A7CN) to the converter, refer to a manual of "heatsink protrusion attachment".

●Heatsink protrusion attachments

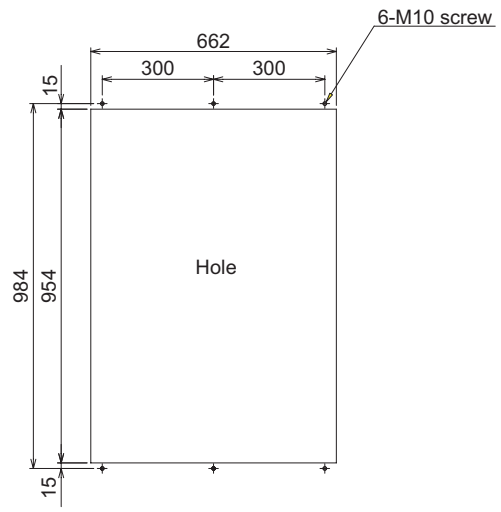
Model Name	Applicable converter
FR-A7CN02	FR-HC2-7.5K
FR-A7CN04	FR-HC2-15K
FR-A7CN05	FR-HC2-30K
FR-A7CN09	FR-HC2-75K FR-HC2-H110K

* For a combination other than above, please contact your sales representative.

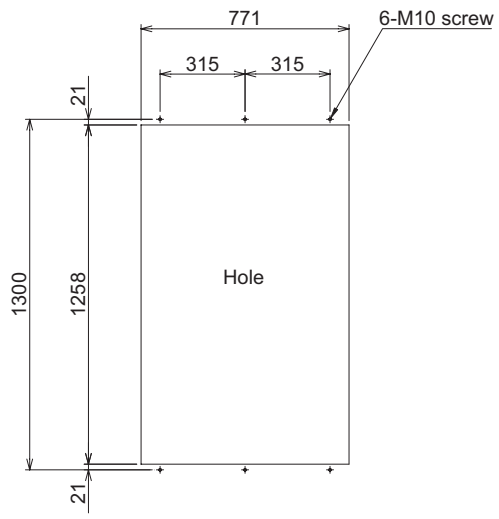
2.4.2 Heatsink protrusion for 280K or higher

(1) Enclosure cut
Cut the enclosure according to the capacity of the converter.

●FR-HC2-H280K



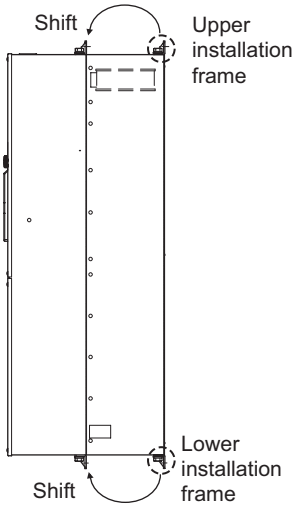
●FR-HC2-H560K



(2) Moving and removing the back installation frames

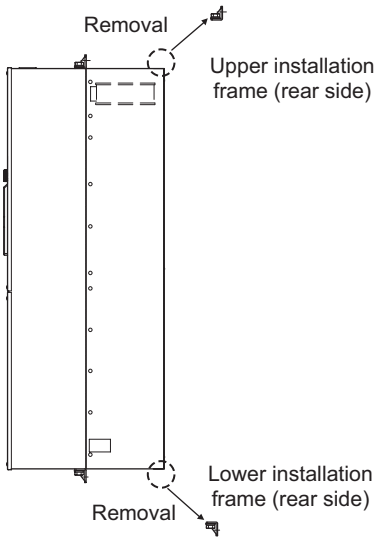
●FR-HC2 -H280K

One installation frame is attached to each of the upper and lower parts of the converter. Change the position of the rear side installation frame on the upper and lower sides of the converter to the front side as shown on the right. When changing the installation frames, make sure that the installation orientation is correct.



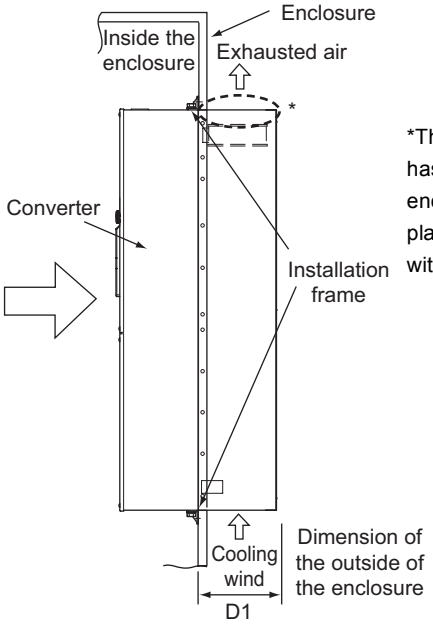
●FR-HC2-H560K

The converter has installation frames: two on the top and the two on the bottom. As shown on the right, remove the back installation frames on the top and bottom of the converter.

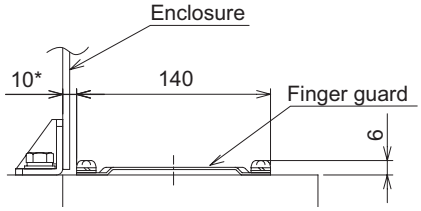


(3) Installing the converter to the enclosure

Protrude the heatsink of the converter from the installation enclosure, and secure the converter using the top and bottom installation frames.



*The enclosure enclosing FR-HC2-H280K and higher has a finger guard on its back. The thickness of the enclosure should be less than 10mm (*), and do not place anything around the finger guard to avoid contact with the finger guard.



Model	D1
FR-HC2-H280K, H560K	184

NOTE

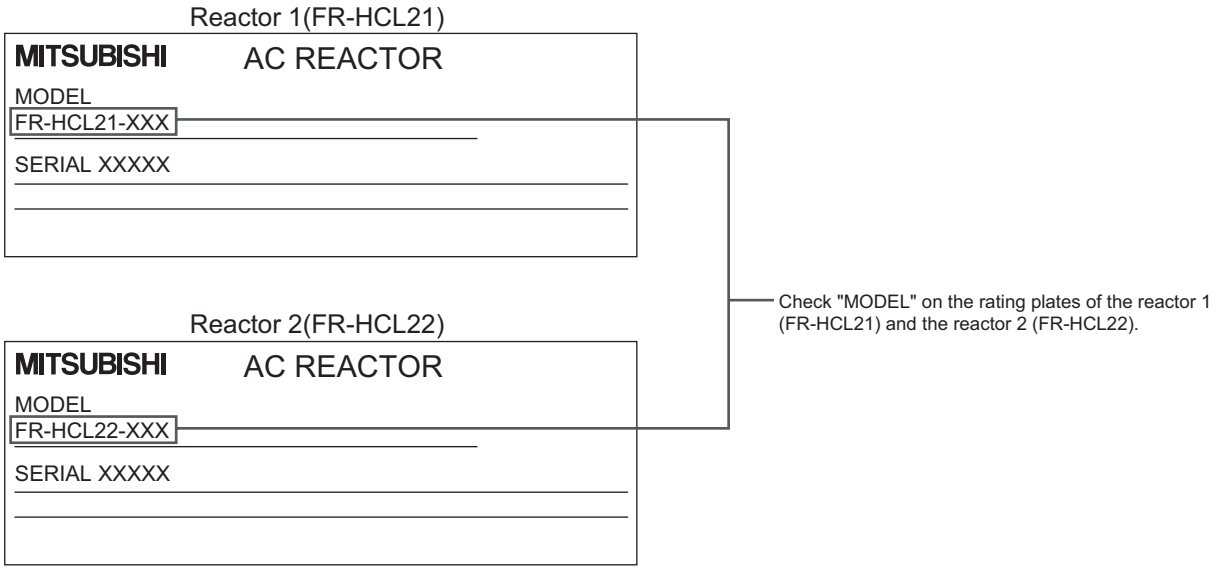
- **Protruding area contains a cooling fan, so it cannot be used in the environment where water drops, oil mist, dust and other substances exist.**
- **Foreign substances such as screws and dust must be prevented to enter in the converter or the cooling fan section.**

2.5 Installation of peripheral devices

2.5.1 Installation of reactor 1 and reactor 2

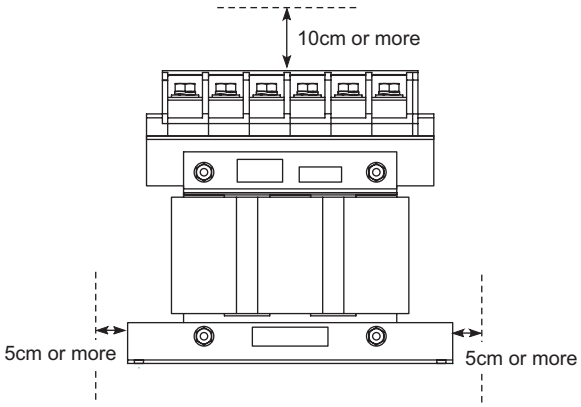
(1) Model name confirmation

Take caution as the appearances of the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22) are very similar.



(2) Clearance

Because the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22) generate heat, leave sufficient space around them.



(3) Installation place

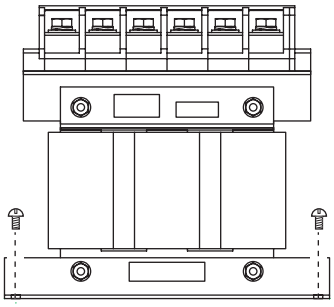
Install the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22) on nonflammable material. Direct installation on a flammable material will cause a fire.

(4) Environment

Avoid places where the equipment is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.
Install the equipment in a clean place or protect them from suspended substances.

(5) Installation orientation

To prevent looseness, install the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22) on a horizontal surface securely with screws or bolts.
Do not install them on a vertical wall. Install them on a mounting stand which can withstand their weight.

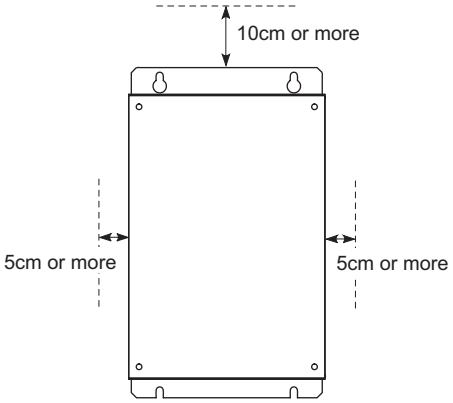


NOTE

Since the charged sections of the reactor 1 and the reactor 2 are uncovered, fully protect them to prevent ground fault and electric shock.

2.5.2 Installation of the outside box (FR-HCB2-7.5K to 75K, FR-HCB2-H75K, H110K)

(1) Clearance



(2) Installation area

Mount the outside box (FR-HCB2) on nonflammable material. Installing it directly on flammable material will cause a fire.

(3) Surrounding environment

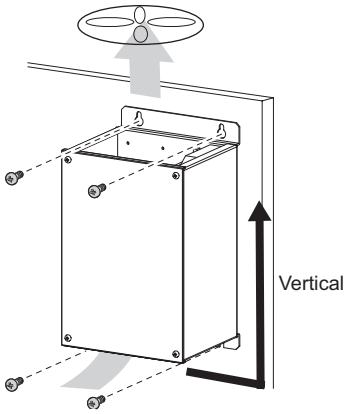
Avoid places where the equipment is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.
Install the equipment in a clean place or protect it from suspended substances.

(4) Installation

Install the outside box (FR-HCB2) vertically.

NOTE

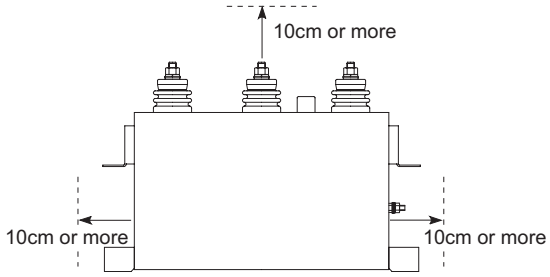
Since the charged sections of the outside box are uncovered, take sufficient protective measures to avoid ground faults and electric shocks.



2.5.3 Installation of filter capacitor (FR-HCC2-H280K, H560K)

(1) Clearance

Because the filter capacitor (FR-HCC2) generates heat, leave sufficient space around it.



(2) Installation place

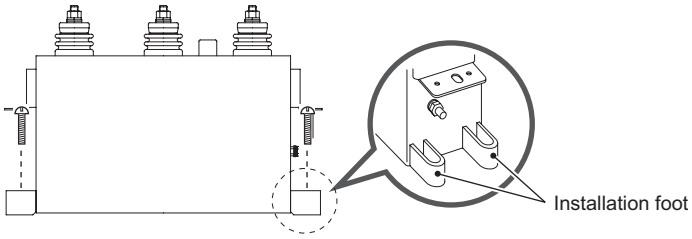
Install the filter capacitor on nonflammable material. Direct installation on a flammable material will cause a fire.

(3) Environment

Avoid places where the equipment is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.
Install the equipment in a clean place or protect them from suspended substances.

(4) Installation orientation

To prevent looseness, install the filter capacitor (FR-HCC2) on a horizontal surface securely with screws or bolts.
Do not install it on a vertical wall. Install it on a mounting stand which can withstand its weight.



NOTE

Since the charged sections of the filter capacitor is uncovered, fully protect it to prevent ground fault and electric shock.

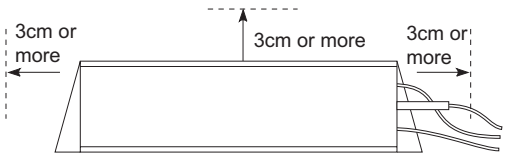
(5) Installation of filter capacitor alarm detector (560K only)

To install a filter capacitor alarm detector (MDA-1), refer to the Instruction Manual appended to the filter capacitor alarm detector, and perform the installation.

2.5.4 Installation of inrush current limit resistor (FR-HCR2-H280K, H560K)

(1) Clearance

Because the limit resistor (FR-HCR2) generates heat, leave sufficient space around it.



(2) Installation place

Install the limit resistor (FR-HCR2) on nonflammable material. Installing directly on or near a flammable material will cause a fire.

(3) Environment

Avoid places where the equipment is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.
Install the equipment in a clean place or protect it from suspended substances.
Do not place a flammable material near the equipment.

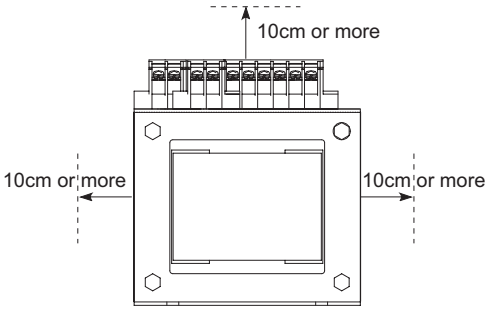
(4) Installation orientation

To prevent looseness, install the inrush current limit resistor (FR-HCR2) on a horizontal or vertical surface securely with screws or bolts.

2.5.5 Installation of stepdown transformer (FR-HCM2-H280K, H560K)

(1) Clearance

Because the stepdown transformer generates heat, leave sufficient space around it.



(2) Installation place

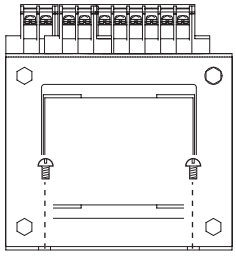
Install the stepdown transformer on nonflammable material. Direct installation on a flammable material will cause a fire.

(3) Environment

Avoid places where the equipment is subjected to oil mist, flammable gases, fluff, dust, dirt, etc.
Install the equipment in a clean place or protect it from suspended substances.

(4) Installation orientation

To prevent looseness, install the stepdown transformer on a horizontal or vertical surface securely with screws or bolts.



NOTE

Since the charged section of the stepdown transformer is uncovered, fully protect it to prevent ground fault and electric shock.

2.6 Main circuit terminal specifications

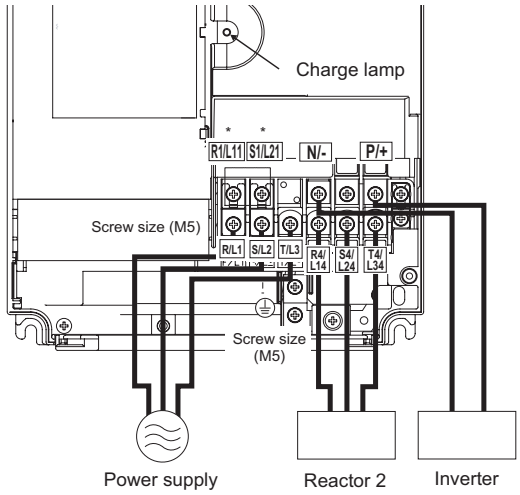
2.6.1 Description of main circuit terminal

Terminal Symbol	Terminal Name	Description
R/L1, S/L2, T/L3	Power input	These terminals are used to detect power phase and power voltage, and to input control power. Connect them to the commercial power supply. If the inverter is operated without connecting them to the commercial power supply, the converter will be damaged.
R4/L14, S4/L24, T4/L34	Power input	Connect them to the reactor 2.
R1/L11, S1/L21	Power supply for control circuit	These terminals are connected to the phase detection terminals R/L1 and S/L2 in the initial status. To retain the fault display and fault output, remove the jumpers (cables) and apply external power to these terminals.
P/+, N/-	Inverter connection	Connect them to the inverter terminals P/+ and N/-.
⏚	Earth (Ground)	For earthing (grounding) the converter chassis. It must be earthed (grounded).

2.6.2 Terminal arrangement of the main circuit terminal

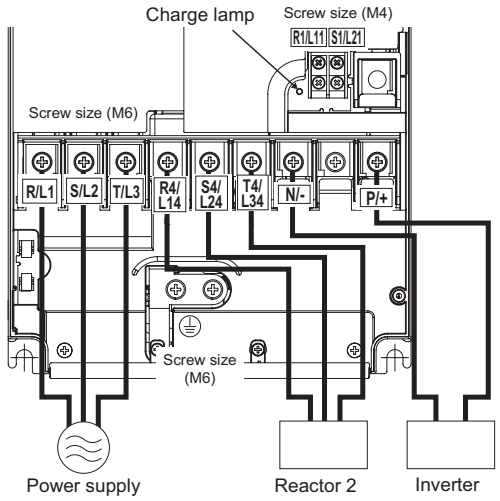
200V class

FR-HC2-7.5K

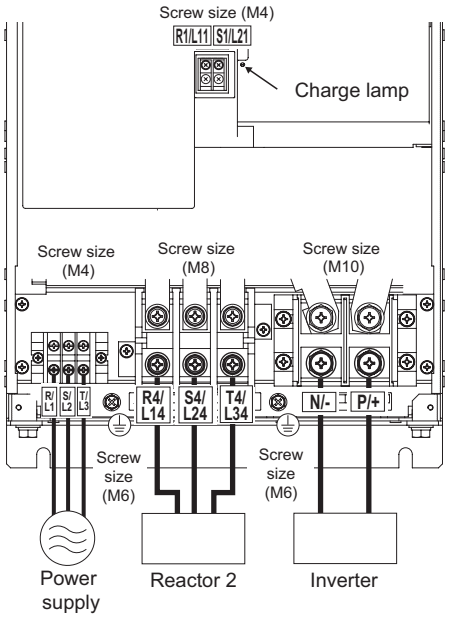


* Screw size for terminals R1/L11 and S1/L21 is M4.

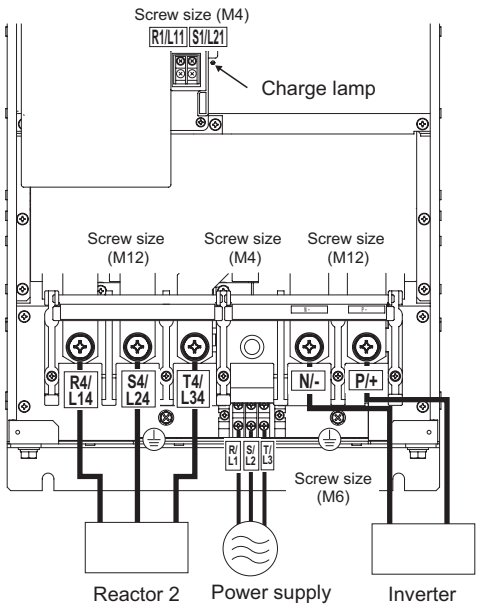
FR-HC2-15K



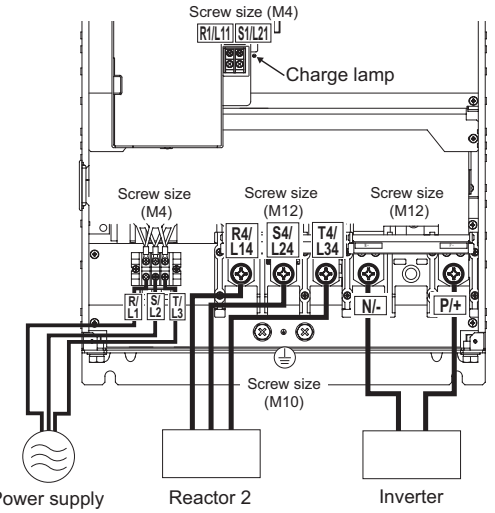
FR-HC2-30K



FR-HC2-55K

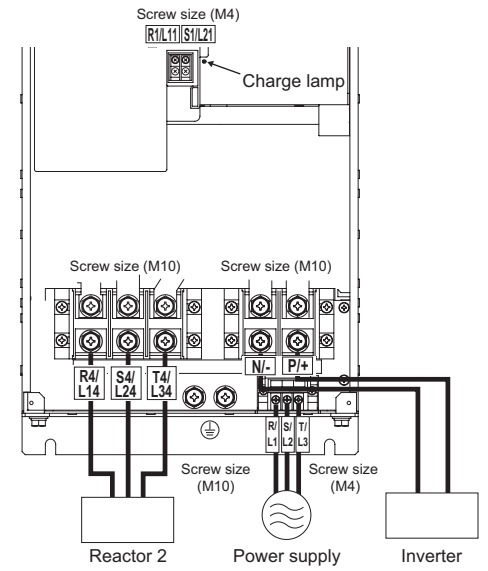


FR-HC2-75K

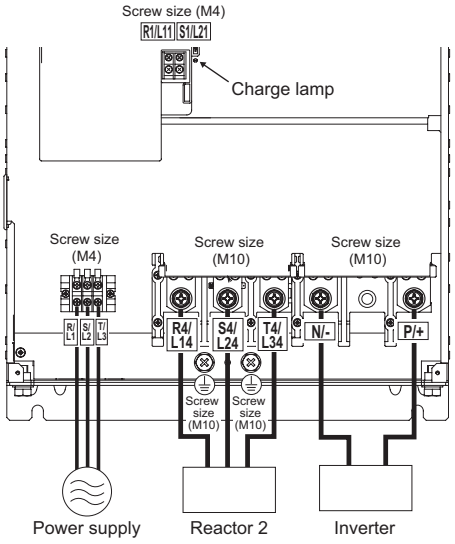


400V class

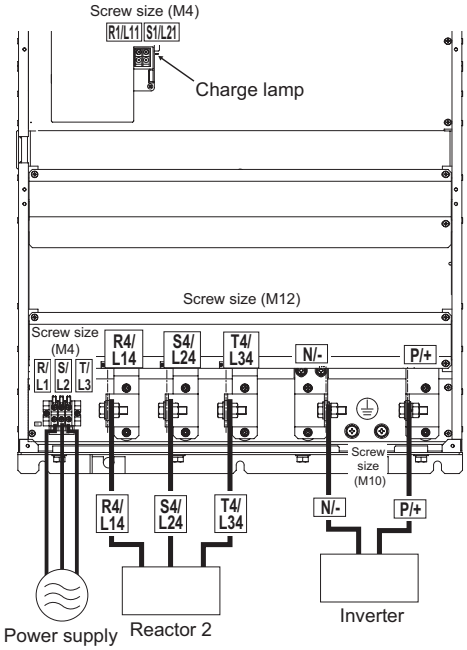
FR-HC2-H75K



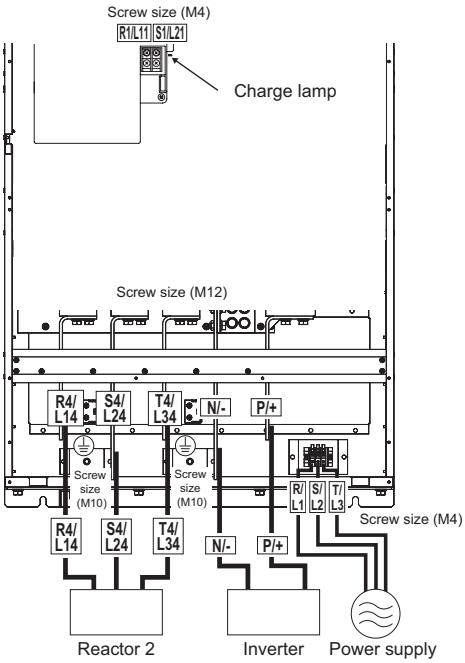
FR-HC2-H110K



FR-HC2-H280K



FR-HC2-H560K



2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals

Select the recommended cable size to ensure that a voltage drop will be 2% max.
If the wiring distance is long between the inverter and motor, a main circuit cable voltage drop will cause the motor torque to decrease especially at the output of a low frequency.
The following table indicates a selection example for the wiring length of 20m

● 200V class (when input power supply is 220V)
<Converter (FR-HC2)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal		Cable Size							
					HIV, etc.(mm²) *1			AWG/MCM *2		PVC, etc.(mm²) *3		
			R4/L14, S4/L24, T4/L34	P/+, N/-	R4/L14, S4/L24, T4/L34	P/+, N/- *5	Earthing cable	R4/L14, S4/L24, T4/L34	P/+, N/- *5	R4/L14, S4/L24, T4/L34	P/+, N/- *5	Earthing cable
FR-HC2-7.5K	M5	2.5	8-5	5.5-5	8	5.5	5.5	8	10	10	6	6
FR-HC2-15K	M6	4.4	22-6	14-6	22	14	14	4	6	25	16	16
FR-HC2-30K	M8/ M10(M6)*4	7.8/14.7	60-8	38-10	60	38	22	1/0	1	50	50	25
FR-HC2-55K	M12(M6)*4	24.5	125-12	100-12	125	100	38	250	4/0	120	95	70
FR-HC2-75K	M12(M10)*4	24.5	100-12	100-12	100	100	38	4/0	4/0	95	95	50

<Outside box (FR-HCB2)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size				
				HIV, etc.(mm²)*1		AWG/MCM *2	PVC, etc.(mm²) *3	
			R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	Earthing cable	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	Earthing cable
FR-HCB2-7.5K	M5	2.5	8-5	8	5.5	8	10	6
FR-HCB2-15K	M5	2.5	22-5	22	14	4	25	16
FR-HCB2-30K	M6	4.4	60-6	60	22	1/0	50	25
FR-HCB2-55K	M8(M6) *4	7.8	125-8	125	38	250	120	35
FR-HCB2-75K	M12(M10) *4	24.5	100-12	100	38	4/0	95	35

<Reactor1 (FR-HCL21)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size		
				HIV, etc.(mm²)*1	AWG/MCM *2	PVC, etc.(mm²) *3
			R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32	R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32	R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32	R/L1, S/L2, T/L3 R2/L12, S2/L22, T2/L32
FR-HCL21-7.5K	M5	2.5	8-5	8	8	10
FR-HCL21-15K	M6	4.4	22-6	22	4	25
FR-HCL21-30K	M8	7.8	60-8	60	1/0	50
FR-HCL21-55K	M12	24.5	125-12	125	250	120
FR-HCL21-75K	M12	24.5	100-12	100	4/0	95

<Reactor2 (FR-HCL22)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size		
				HIV, etc.(mm²)*1	AWG/MCM *2	PVC, etc.(mm²) *3
			R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34	R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34	R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34	R3/L13, S3/L23, T3/L33 R4/L14, S4/L24, T4/L34
FR-HCL22-7.5K	M5	2.5	8-5	8	8	10
FR-HCL22-15K	M6	4.4	22-6	22	4	25
FR-HCL22-30K	M8	7.8	60-8	60	1/0	50
FR-HCL22-55K	M12	24.5	125-12	125	250	120
FR-HCL22-75K	M12	24.5	100-12	100	4/0	95

∗1 For the 55K or lower, the cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. It assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.
For the 75K or higher, the recommended cable size is that of the cable (LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc.) with continuous maximum permissible temperature of 90°C. It assumes that the surrounding air temperature is 50°C or less and wiring is performed in an enclosure.

∗2 The recommended cable size is that of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. It assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less. (Selection example for use mainly in the United States.)

∗3 For the 15K or lower, the recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. It assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less. For the 30K or higher, the recommended cable size is that of the cable (XLPE cable) with continuous maximum permissible temperature of 90°C. It assumes that the surrounding air temperature is 40°C or less and wiring is performed in an enclosure. (Selection example for use mainly in Europe.)

∗4 Screw size for earthing (grounding) is indicated in parenthesis.

∗5 If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (*Refer to page 11* for the fuse selection.)

● **400V class (when input power supply is 440V)**

<Converter (FR-HC2)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal		Cable Size								
					HIV, etc.(mm²) *1			AWG/MCM *2		PVC, etc.(mm²) *3		
			R4/L14, S4/L24, T4/L34	P/+, N/-	R4/L14, S4/L24, T4/L34	P/+, N/- *5	Earthing cable	R4/L14, S4/L24, T4/L34	P/+, N/- *5	R4/L14, S4/L24, T4/L34	P/+, N/- *5	Earthing cable
FR-HC2-H75K	M10(M10) *4	14.7	38-10	38-10	38	38	38	1	1	50	50	25
FR-HC2-H110K	M10(M10) *4	14.7	60-10	60-10	60	60	38	1/0	2/0	50	70	35
FR-HC2-H280K	M12(M10) *4	24.5	200-12	150-12	200	2 × 125	60	400	2 × 350	185	2 × 120	120
FR-HC2-H560K	M12(M10) *4	24.5	C2-250	C2-250	2 × 250	3 × 250	100	2 × 500	2 × 600	2 × 240	3 × 240	2 × 150

<Outside box (FR-HCB2)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size				
				HIV, etc.(mm²) *1		AWG/MCM *2	PVC, etc.(mm²) *3	
			R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	Earthing cable	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	R2/L12, S2/L22, T2/L32 R3/L13, S3/L23, T3/L33	Earthing cable
FR-HCB2-H75K	M8(M8) *4	7.8	38-10	38	38	1	50	25
FR-HCB2-H110K	M10(M10) *4	14.7	60-10	60	38	1/0	50	25
FR-HCC2-H280K	M12(M8) *4	15.0	60-12	60	60	1/0	50	50
FR-HCC2-H560K	M12(M8) *4	25.0	38-12	38	38	1	50	50

<Reactor1 (FR-HCL21)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size		
				HIV, etc.(mm²) *1	AWG/MCM *2	PVC, etc.(mm²) *3
			R/L1,S/L2,T/L3 R2/L12,S2/L22,T2/L32	R/L1,S/L2,T/L3 R2/L12,S2/L22,T2/L32	R/L1,S/L2,T/L3 R2/L12,S2/L22,T2/L32	R/L1,S/L2,T/L3 R2/L12,S2/L22,T2/L32
FR-HCL21-H75K	M10	14.7	38-10	38	1	50
FR-HCL21-H110K	M12	24.5	60-12	60	1/0	50
FR-HCL21-H280K	M12	24.5	200-12	200	400	185
FR-HCL21-H560K	M12	24.5	C2-250	2 × 250	2 × 500	2 × 240

<Reactor2 (FR-HCL22)>

Model Name	Terminal Screw Size	Tightening Torque N•m	Crimping Terminal	Cable Size		
				HIV, etc.(mm²) *1	AWG/MCM *2	PVC, etc.(mm²) *3
			R3/L13,S3/L23,T3/L33 R4/L14,S4/L24,T4/L34	R3/L13,S3/L23,T3/L33 R4/L14,S4/L24,T4/L34	R3/L13,S3/L23,T3/L33 R4/L14,S4/L24,T4/L34	R3/L13,S3/L23,T3/L33 R4/L14,S4/L24,T4/L34
FR-HCL22-H75K	M10	14.7	38-10	38	1	50
FR-HCL22-H110K	M10	14.7	60-10	60	1/0	50
FR-HCL22-H280K	M12	24.5	200-12	200	400	185
FR-HCL22-H560K	M12	24.5	C2-250	2 × 250	2 × 500	2 × 240

*1 The recommended cable size is that of the cable (LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc.) with continuous maximum permissible temperature of 90°C. It assumes the surrounding air temperature of 50°C or lower and in-enclosure wiring.

*2 The recommended cable size is that of the cable (THHN cable) with continuous maximum permissible temperature of 90°C. It assumes that the surrounding air temperature is 40°C or less and in-enclosure wiring. (Selection example for use mainly in the United States.)

*3 The recommended cable size is that of the cable (XLPE cable) with continuous maximum permissible temperature of 90°C. It assumes the surrounding air temperature is 40°C or lower and in-enclosure wiring. (Selection example for use mainly in Europe.)

*4 Screw size for earthing (grounding) is indicated in parentheses.

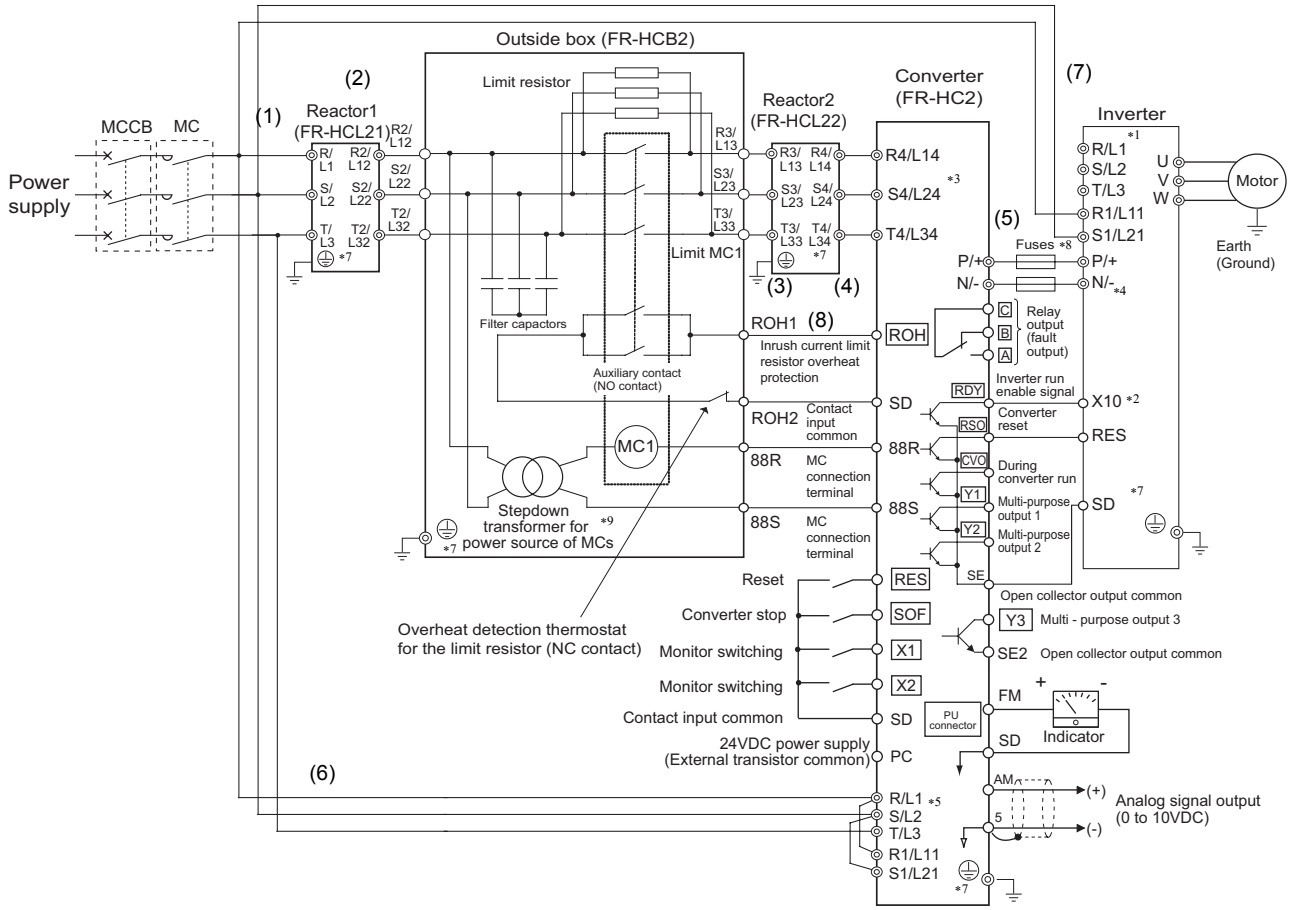
*5 If a cable thinner than the recommended cable size is used, it may not be protected by the DC fuse. (*Refer to page 11* for the fuse selection.)

2.7 Wiring of main circuit (FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K)

- Perform wiring securely to conform with the harmonic suppression guideline of the former Ministry of International Trade and Industry (currently the Japanese Ministry of Economy, Trade and Industry). Incorrect wiring causes the converter to display an alarm or causes an fault or damage.
- Refer to the Instruction Manual of each inverter for the wiring of the inverter. Special attention must be paid to the wiring length and wire gauge.

2.7.1 Connection diagram (when using with the FR-A700 series)

Connection method differs by the inverter series. Perform connection by referring to the Instruction Manual of the inverter.



*1 Do not connect anything to the inverter power input terminals R/L1, S/L2 and T/L3. Incorrect connection will damage the inverter. Connecting opposite polarity of terminals P and N will damage the converter and the inverter.

*2 Use input terminal function selection to assign the terminal used for X10 signal. (Refer to the Inverter Instruction Manual.)

*3 The power phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched.

*4 Do not insert MCCB between terminals P and N (P and P, N and N).

*5 Always connect the terminal R/L1, S/L2, T/L3 of the converter to the power supply. If the inverter is operated without connecting the terminals to the power supply, the converter will be damaged.

*6 Do not insert MCCB or MC between (1) (terminal R/L1, S/L2, and T/L3 input of the Reactor 1) and (4) (terminal R4/L14, S4/L24, and T4/L34 input of the converter) of the above diagram. It will not operate properly.

*7 Securely perform grounding (earthing) by using the grounding (earthing) terminal.

*8 Installation of a fuse is recommended. *(Refer to page 11)*

*9 The stepdown transformer for the MC power source is only equipped in the 400V class models.

Number	Wiring	Refer to page
(1)	Power supply and reactor 1	*33*
(2)	Reactor 1 and outside box	*33*
(3)	Outside box and reactor 2	*34*
(4)	Reactor 2 and converter	*34*
(5)	Converter and inverter	*35*
(6)	Reactor 1 and converter	*36*
(7)	Power supply and inverter	*36*
(8)	Outside box and converter	*37*

NOTE

- **When connecting the converter to the inverter, match the control logic (sink logic (initial setting)/source logic). The converter does not operate properly if the control logic is different.**
  (*Refer to page 56* for the switching of the control logic. Refer to Inverter Instruction Manual for the switching of the control logic of the inverter.)
- **Keep the wiring length between terminals as short as possible.**
- **When sudden large distortion or depression of power supply occurs, reactor may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

⚠ CAUTION

⚠ Check the connection order of the reactor 1 and the reactor 2. Incorrect connection may damage the converter and reactors.

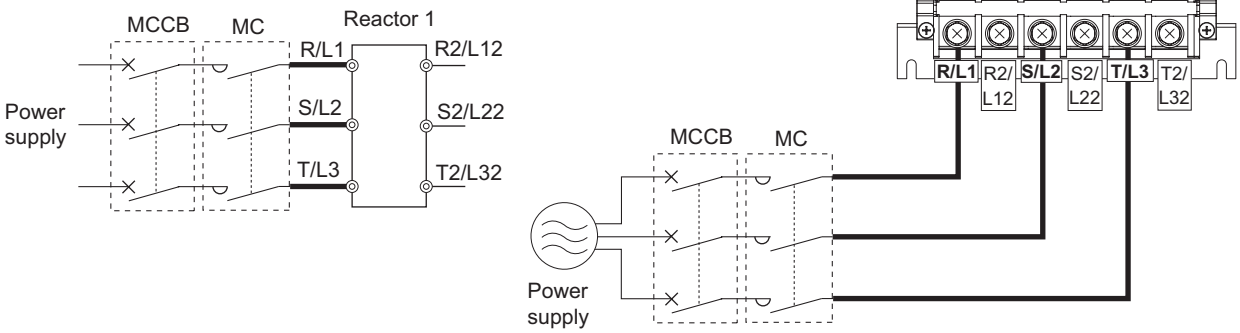
⚠ Always connect the terminal RDY of the converter to the terminal MRS or the inverter terminal of which X10 signal is assigned to. Also, always connect the terminal SE of the converter to the terminal SD of the inverter. If these are not connected, the converter may be damaged.

2.7.2 Wiring of main circuit

(1) Wiring of power supply and reactor 1

- Cable size differs by capacity. Select an appropriate cable by referring to *2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals (refer to page 29)* and perform wiring.

<Wiring example of 7.5K>



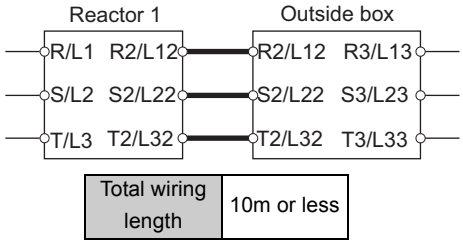
∗ The terminal arrangement differs by capacity. Check the terminal arrangement on *6.3 Outline dimensions (refer to page 148)*.

(2) Wiring of reactor 1 and outside box

- Cable size differs by the capacity. Select an appropriate cable by referring to *2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals (refer to page 29)* and perform wiring.
- The 400V class outside box is equipped with a stepdown transformer for the power supply of MCs. Switch the tap (V1, V2, V3) of the stepdown transformer according to the input power supply voltage as shown in the table below.

Power Supply Voltage	Switching Tap Position
380V or more, less than 400V	V1
400V or more, 440V or less	V2
More than 440V, 460V or less	V3

<Wiring example of 7.5K>

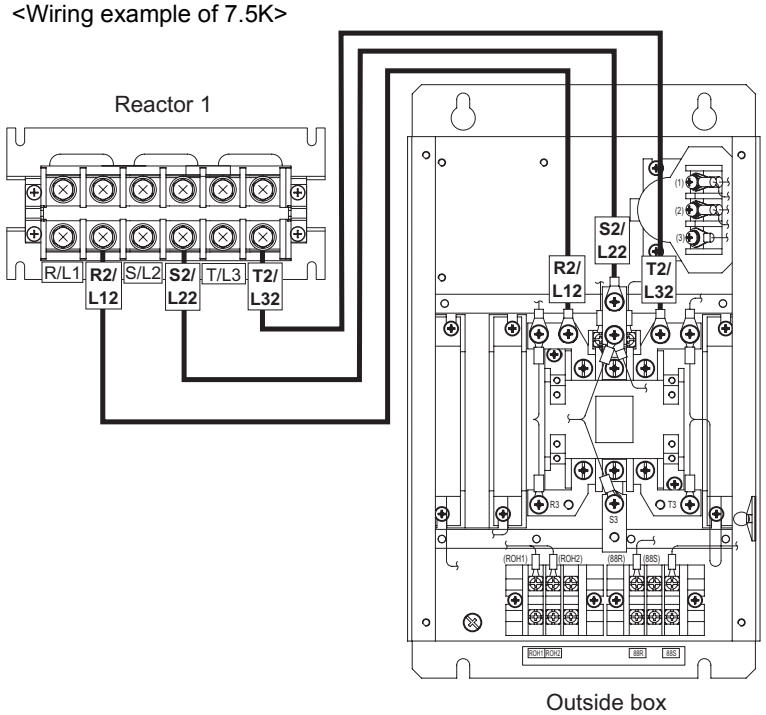


Total wiring length	10m or less

- Outside box terminal screws (accessory)

Capacity	Screw size	Quantity
7.5K, 15K	M5	6

∗ Use the enclosed screws (M5) for the wiring of 7.5K and 15K.



∗ The terminal arrangement differs by capacity. Check the terminal arrangement on *6.3 Outline dimensions (refer to page 148)*.

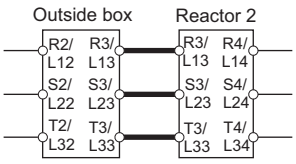
NOTE

- **Because the reactor heats up, install the reactor in a place where the outside box will be unaffected by heat.**
- **Perform wiring where the wire sheath does not touch the reactor.**

(3) Wiring of outside box and reactor 2

- Cable size differs by capacity. Select an appropriate cable by referring to *2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals (refer to page 29)* and perform wiring.

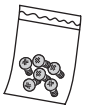
<Wiring example of 7.5K>



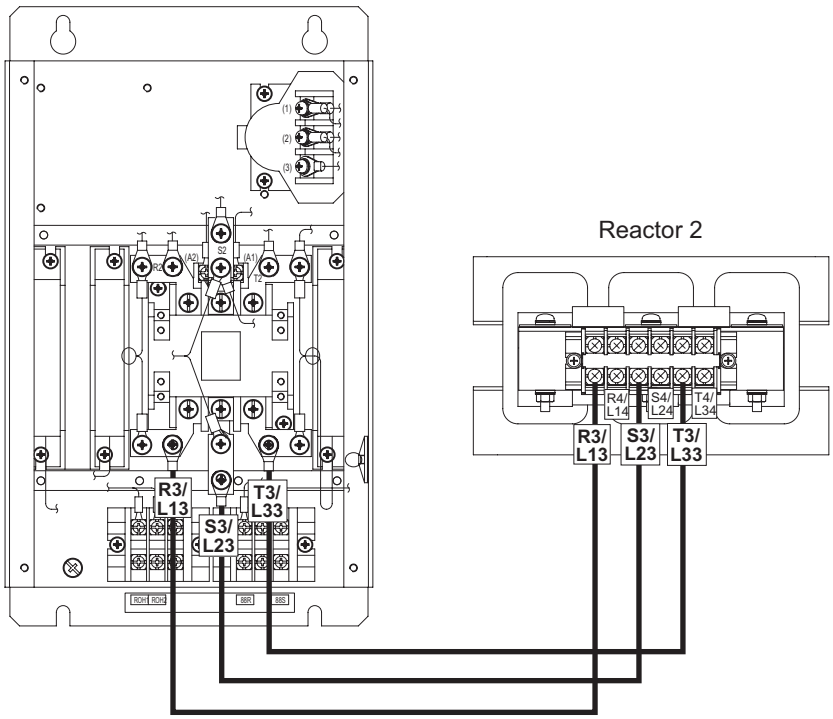
Total wiring length	10m or less

- Outside box terminal screws (accessory)

Capacity	Screw size	Quantity
7.5K, 15K	M5	6



* Use the enclosed screws (M5) for the wiring of 7.5K and 15K.

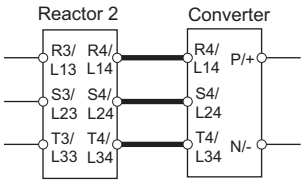


* The terminal arrangement differs by capacity. Check the terminal arrangement on *6.3 Outline dimensions (refer to page 148)*.

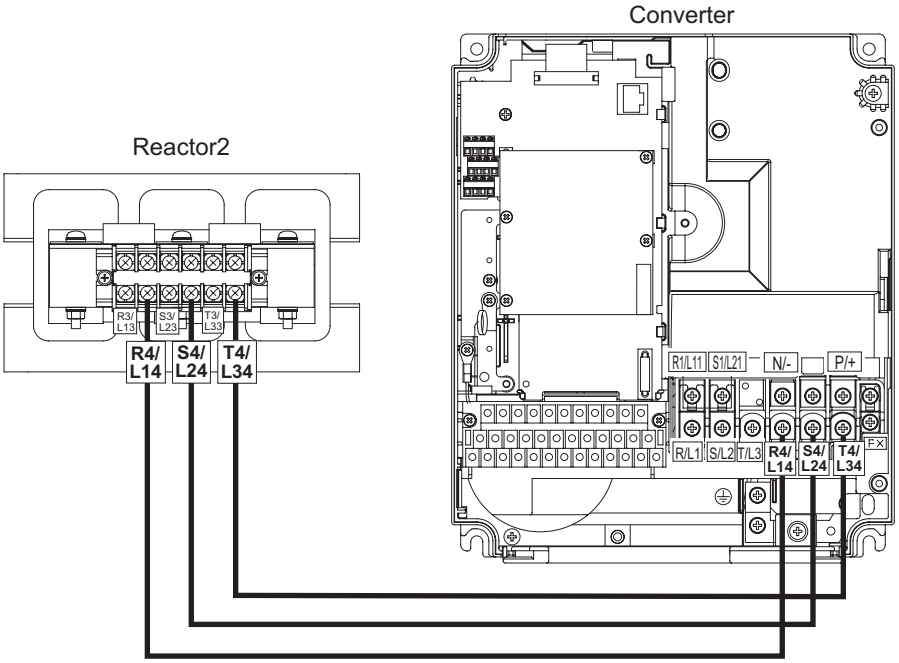
(4) Wiring of reactor 2 and high power factor converter

- Cable size differs by capacity. Select an appropriate cable by referring to *2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals (refer to page 29)* and perform wiring.

<Wiring example of 7.5K>



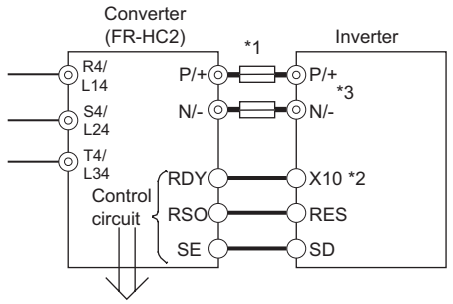
Total wiring length	10m or less



* The terminal arrangement differs by capacity. Check the terminal arrangement on *2.6.2 Terminal arrangement of the main circuit terminal (refer to page 27)* and *6.3 Outline dimensions (refer to page 148)*.

(5) Wiring of high power factor converter and inverter

- These units should be connected to transmit commands from the high power factor converter to the inverter securely. Connection method differs depending on the inverter series. Refer to the Instruction Manual of the inverter when connecting.
  Refer to the below table for the wiring length.
  For the wire gauge of the main circuit terminals P/+ and N/- (across P and P, across N and N), refer to *2.6.3 Cable sizes of the main control circuit terminals and earth (ground) terminals (refer to page 29)*.



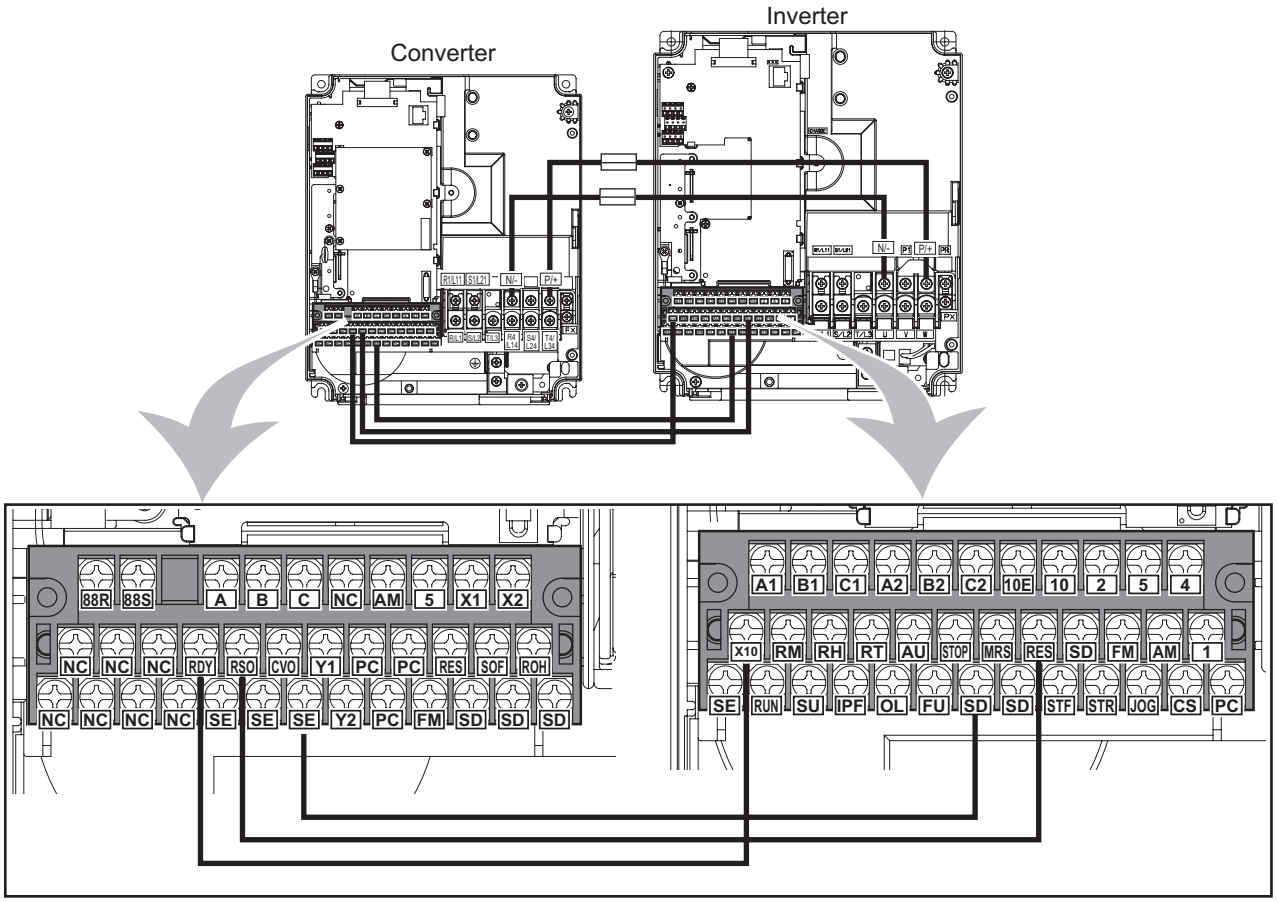
Cable gauge for the control circuit	0.75 to 1.25mm^2

*1 Installation of a fuse is recommended to avoid the damage to spread in case of an inverter failure. Select a fuse according to the motor capacity. When using a motor, of which the capacity is smaller than the inverter capacity by two ranks or more, select the fuse with the capacity that is one rank lower than the inverter capacity. Refer to the fuse selection table on page *11*, *12*.
When connecting several inverters, the wire gauge of terminal P/+ and N/- should be same as the wire gauge of the inverter's power supply side. (Refer to the inverter manual.)

*2 The function of the inverter terminal, which is connected to the terminal RDY of the converter, needs to be set at the inverter side.

*3 Refer to the Inverter Instruction Manual.
Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).

<Wiring example of 7.5K>


Converter
Inverter
88R 88S A B C NC AM 5 X1 X2
NC NC NC RDY RSO CVO Y1 PC PC RES SOF ROH
NC NC NC NC SE SE SE Y2 PC FM SD SD SD
A1 B1 C1 A2 B2 C2 10E 10 2 5 4
X10 RM RH RT AU STOP MRS RES SD FM AM 1
SE RUN SU IPF OL FU SD SD STF STR JOG CS PC

* The terminal arrangement in the main circuit differs by capacity. Check the terminal arrangement on *2.6.2 Terminal arrangement of the main circuit terminal (refer to page 27)*.

Total wiring length	Across terminals P and P Across terminals N and N	50m or less
	Other control signal lines	30m or less

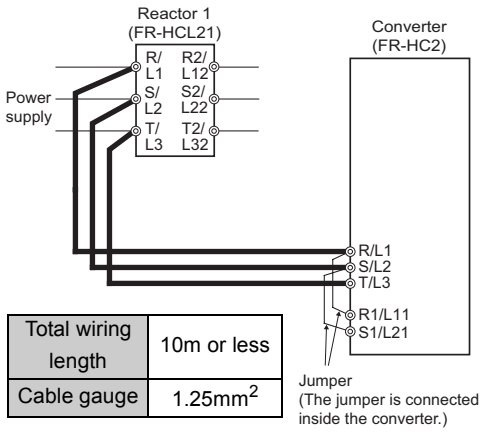
NOTE

- **The converter operates as a common converter. Use terminals P/+ and N/- to connect it with the inverter. Do not connect anything to the inverter power input terminals R/L1, S/L2, and T/L3. Incorrect connection to the inverter power input will damage the inverter. Connecting opposite polarity of terminals P/+ and N/- will damage the inverter and the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

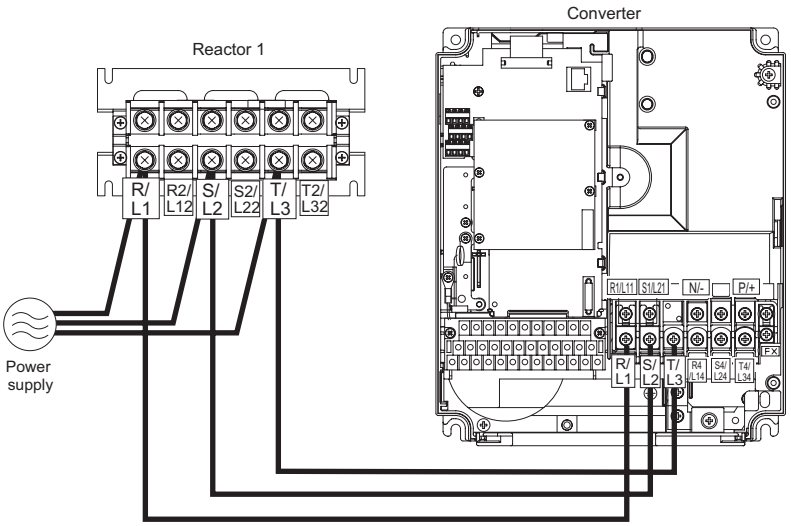
(6) Wiring reactor 1 and converter

Supply power to the power detecting terminals (R/L1, S/L2, T/L3) separately from the main circuit wiring.

<Wiring example of 7.5K>



Total wiring length	10m or less
Cable gauge	1.25mm^2



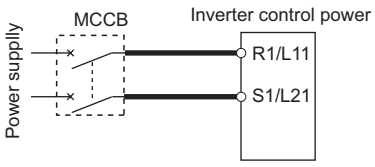
* The terminal arrangement differs by capacity. Check the terminal arrangement on *2.6.2 Terminal arrangement of the main circuit terminal (refer to page 27)* and *6.3 Outline dimensions (refer to page 148)*.

NOTE

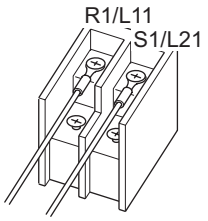
- **The terminal R/L1, S/L2 and T/L3 of the converter are control terminals to detect power supply phases of the power supply. The voltage phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched. If these terminals are not connected correctly, the converter does not operate properly.**
- **If the inverter is operated without connecting the terminals R, S, T of the converter to the power supply, the converter will be damaged.**

(7) Wiring of the power supply and inverter

For the inverters equipped with the control circuit power supply terminals (R1/L11 and S1/L21), connect the control circuit power supply terminals (R1/L11 and S1/L21) directly to the power supply. Do not connect through the converter.



Cable gauge	0.75 to 2mm^2



NOTE

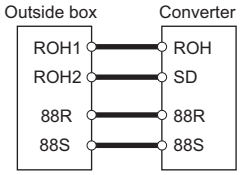
- **Refer to the inverter manual, and remove the jumpers across terminals R/L1and R1/L11 and across terminals S/L2 and S1/L21 on the inverter main circuit.**
- **For the inverters equipped with the control circuit power supply terminals (R1/L11 and S1/L21), always connect the power supply to the terminals. Inverter control power is provided. If not connected, the inverter may trip or be damaged.**
- **Power supply and the inverter are not connected for the inverters not equipped with control circuit power supply terminals (R1/L11 and S1/L21).**

(8) Wiring of outside box and high power factor converter

- Use the cable shown in the below table for the connection.

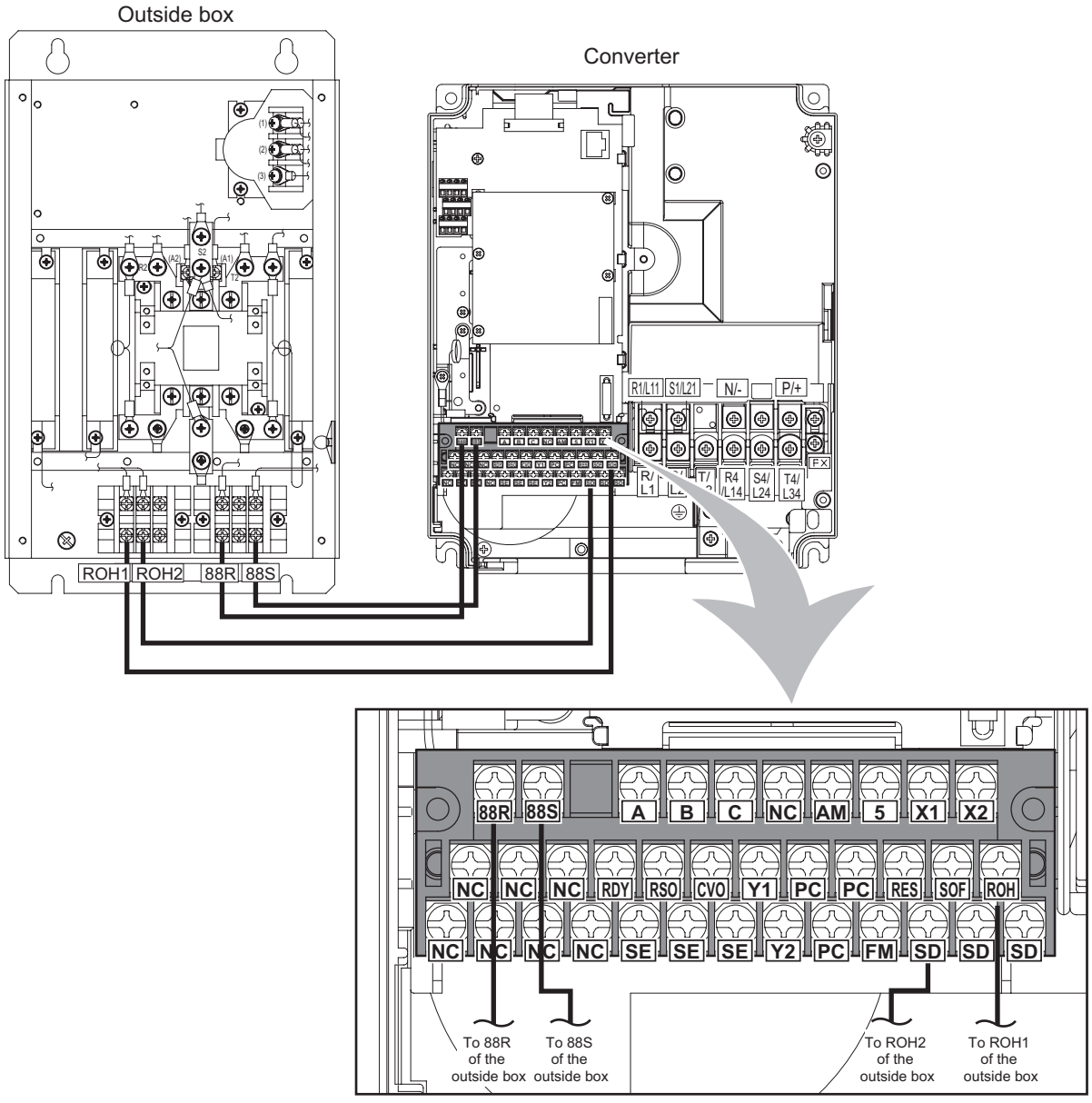
Cable gauge	0.75 to 1.25mm^2

- Converter terminals ROH and SD are used for the control signal for the inrush current limit circuit inside the outside box. Always connect them to the outside box. Failure to do so will cause internal circuit breakage of the outside box.
- Connect the output from the MC start command terminals (88R, 88S) to the terminals (88R, 88S) of the outside box.



Total wiring length	10m or less

<Wiring example of 7.5K>



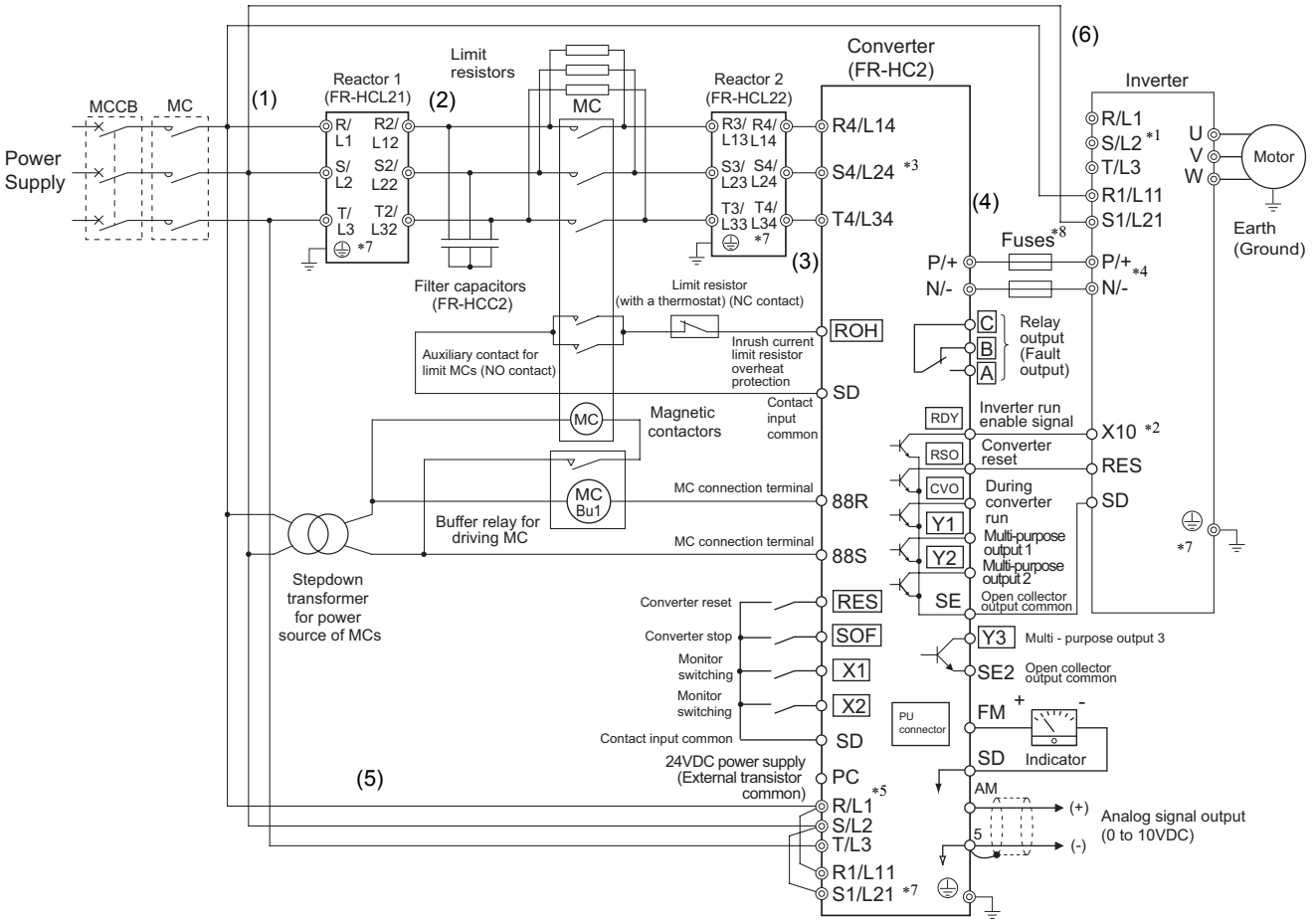
* The terminal arrangement in the outside box differs by capacity. Check the terminal arrangement on *6.3 Outline dimensions (refer to page 148)*.

2.8 Wiring of main circuit (FR-HC2-H280K)

- Perform wiring securely to conform with the harmonic suppression guideline of the former Ministry of International Trade and Industry (currently the Japanese Ministry of Economy, Trade and Industry). Incorrect wiring causes the converter to display an alarm or causes an fault or damage.
- Refer to the Instruction Manual of each inverter for the wiring of the inverter. Special attention must be paid to the wiring length and wire gauge.

2.8.1 Connection diagram (when using with the FR-A700 series)

Connection method differs by the inverter series. Perform connection by referring to the Instruction Manual of the inverter.



*1 Do not connect anything to the inverter power input terminals R/L1, S/L2 and T/L3. Incorrect connection will damage the inverter. Connecting opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.

*2 Use input terminal function selection to assign the terminal used for X10 signal. (Refer to the Inverter Instruction Manual.)

*3 The power phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched.

*4 Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).

*5 Always connect the terminal R/L1, S/L2, T/L3 of the converter to the power supply. If the inverter is operated without connecting the terminals to the power supply, the converter will be damaged.

*6 Do not insert MCCB or MC between (1) (terminal R/L1, S/L2, and T/L3 input of the Reactor 1) and (3) (terminal R4/L14, S4/L24, and T4/L34 input of the converter) of the above diagram. It will not operate properly (except for the limit MC).

*7 Securely perform grounding (earthing) by using the grounding (earthing) terminal.

*8 Installation of a fuse is recommended. *(Refer to page 12)*

Number	Wiring	Refer to page
(1)	Power supply and reactor 1	*40*
(2)	Reactor 1 and reactor 2	*40*
(3)	Reactor 2 and converter	*41*
(4)	Converter and inverter	*42*
(5)	Reactor 1 and converter	*42*
(6)	Power supply and inverter	*43*

NOTE

- **When connecting the converter to the inverter, match the control logic (sink logic (initial setting)/source logic). The converter does not operate properly if the control logic is different.**
  (*Refer to page 56* for the switching of the control logic. Refer to Inverter Instruction Manual for the switching of the control logic of the inverter.)
- **Keep the wiring length between terminals as short as possible.**
- **When sudden large distortion or depression of power supply occurs, reactor may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

⚠ CAUTION

⚠ **Check the connection order of the reactor 1 and the reactor 2. Incorrect connection may damage the converter and reactors.**

⚠ **Always connect the terminal RDY of the converter to the terminal MRS or the inverter terminal of which X10 signal is assigned to. Also, always connect the terminal SE of the converter to the terminal SD of the inverter. If these are not connected, the converter may be damaged.**

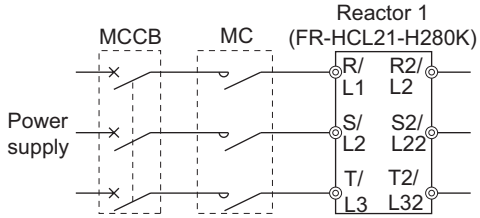
2.8.2 Wiring of main circuit

(1) Wiring power supply and reactor 1

- Use the cable shown in the below table for the connection.

Cable gauge	200mm^2

- Use the moulded case circuit breaker (MCCB), the earth leakage circuit breaker (ELB) or the magnetic contactor (MC) shown in the below table.



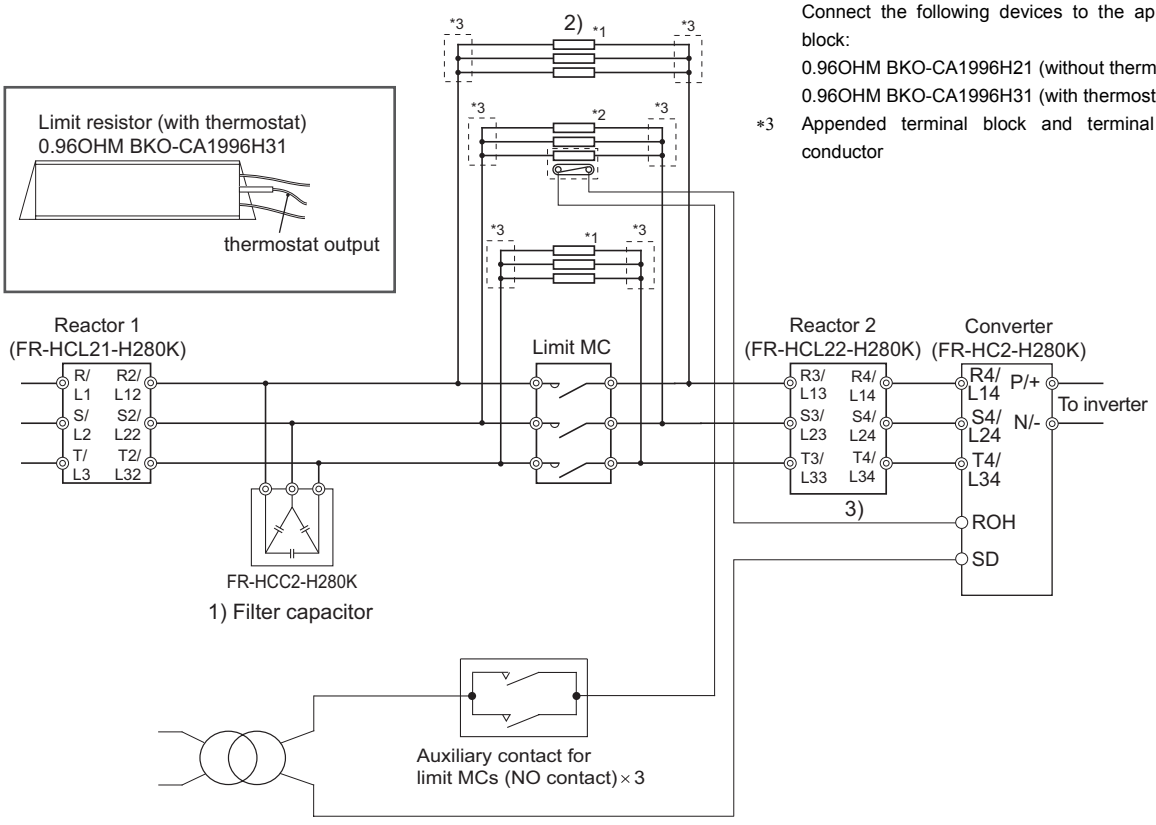
Moulded Case Circuit Breaker (MCCB) or Earth Leakage Circuit Breaker (ELB) (NF or NV type)	700A
Magnetic Contactor (MC)	S-N600

(2) Wiring reactor 1, filter capacitor, limit resistor, limit MC, and reactor 2

∗1 Inrush current limit resistor
Connect the following devices to the appended terminal block:0.96OHM BKO-CA1996H21 (without thermostat) × 3

∗2 Inrush current limit resistor (only S-phase)
Connect the following devices to the appended terminal block:
0.96OHM BKO-CA1996H21 (without thermostat) × 2
0.96OHM BKO-CA1996H31 (with thermostat) × 1

∗3 Appended terminal block and terminal block shorting conductor

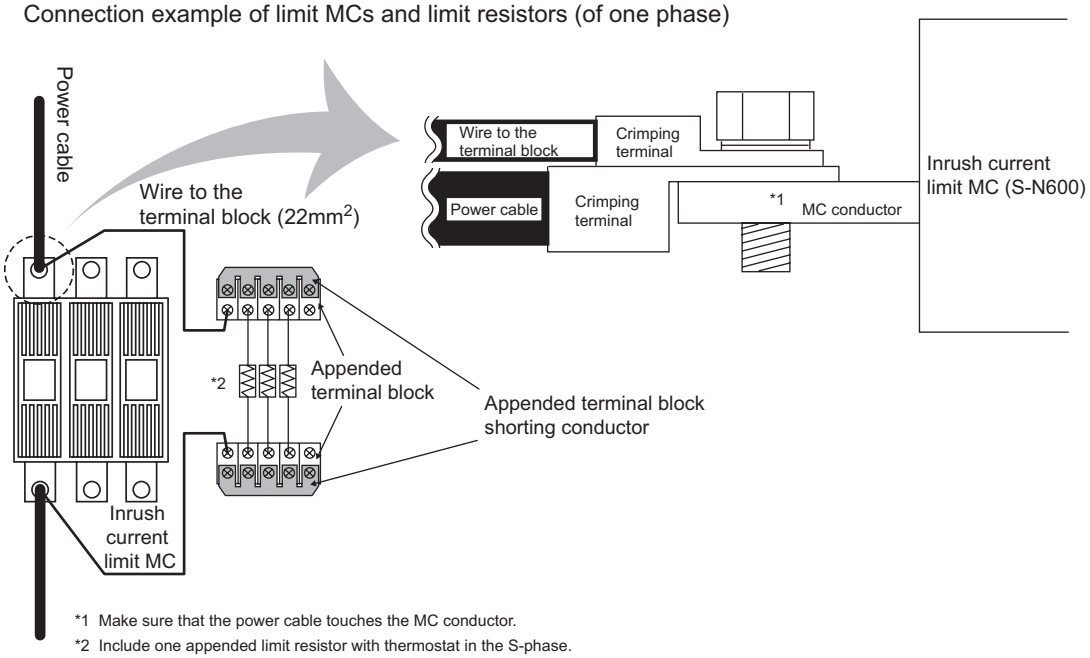


1) Filter capacitor
Install three filter capacitors in parallel to the output side of the reactor 1 or to the input side of the limit MC as shown in the above diagram.
Use the cable shown in the table below for the connection of filter capacitor.

Cable gauge	60mm^2
Wiring length	2m or less

2) Limit resistor, limit MC
Install a pair of a limit resistor and a limit MC to the output side of the reactor 1, and install another pair of those to the input side of the reactor 2.
Install the limit resistor to the appended terminal block. Short a terminal block with a terminal block shorting conductor, and use them as a pair in each phase. Connect the appended terminal blocks to the appended limit MCs.

Connection example of limit MCs and limit resistors (of one phase)



*1 Make sure that the power cable touches the MC conductor.
*2 Include one appended limit resistor with thermostat in the S-phase.

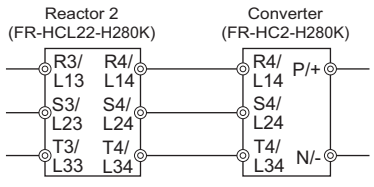
Use the cable shown in the below table for the connection of each phase between the reactor 1 and reactor 2.

Cable gauge	200mm^2
Total wiring length	10m or less

3) Connecting limit resistor thermostats to the converter
Connect a limit resistor thermostat across the converter terminals ROH and SD.

(3) Wiring reactor 2 and converter

- Use the cable shown in the below table for the connection.

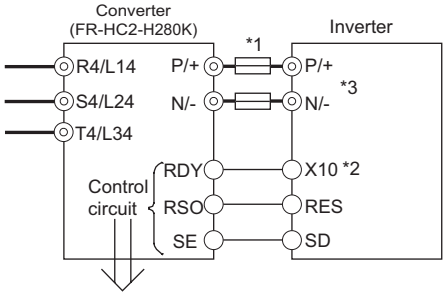


Cable gauge	200mm^2
Total wiring length	10m or less

(4) Wiring example of converter and inverter

- These units should be connected to transmit commands from the converter to the inverter securely.
  Connection method differs depending on the inverter series. Refer to the Instruction Manual of the inverter when connecting. Refer to the below table for the wiring length.

Across terminals P and P / terminals N and N	50m or less
Other control signal lines	30m or less



Cable gauge for the control circuit	0.75 to 2mm^2

∗1 Installation of a fuse is recommended to avoid the damage to spread in case of an inverter failure. Select a fuse according to the motor capacity. When using a motor, of which the capacity is smaller than the inverter capacity by two ranks or more, select the fuse capacity according to the inverter capacity. Refer to the fuse selection table on page *11*, *12*.
When connecting several inverters, the wire gauge of terminal P/+ and N/- should be same as the wire gauge of the inverter's power supply side. (Refer to the inverter manual.)

∗2 The function of the inverter terminal, which is connected to the terminal RDY of the converter, needs to be set at the inverter side.

∗3 Refer to the Inverter Instruction Manual.
Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).

NOTE

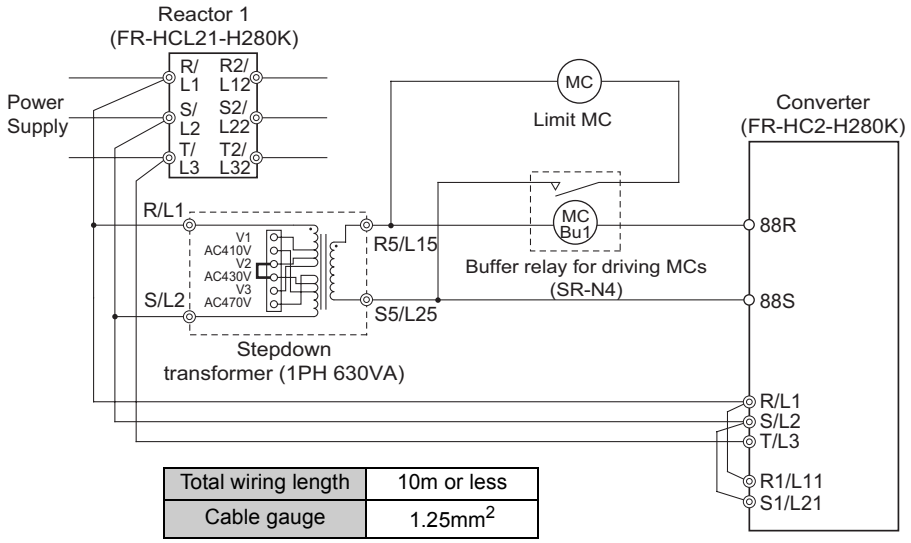
- **The converter operates as a common converter. Use terminals P/+ and N/- to connect it with the inverter. Do not connect anything to the inverter power input terminals R/L1, S/L2, and T/L3. Incorrect connection to the inverter power input will damage the inverter. Connecting opposite polarity of terminals P/+ and N/- will damage the inverter and the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

(5) Wiring reactor 1 and converter

Supply power to the power detecting terminals (R/L1, S/L2, T/L3) separately from the main circuit wiring.
Switch the tap (V1, V2, V3) of the stepdown transformer according to the input power supply voltage as shown in the below table.

Power Supply Voltage	Switching Tap Position
380V or more, less than 400V	V1
400V or more, 440V or less	V2
More than 440V, 460V or less	V3

Connect the MC start command terminals (88R, 88S) to the MC for the limit resistor (for three phases) through the buffer relay.



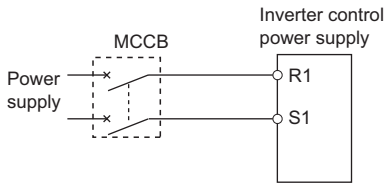
Total wiring length	10m or less
Cable gauge	1.25mm^2

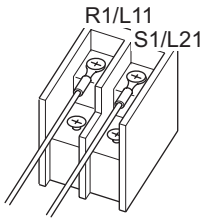
NOTE

- **The terminal R/L1, S/L2, and T/L3 of the converter are control terminals to detect power supply phases of the power supply. The voltage phases of the terminals R4/L14, S4/L24 and T4/L34 and the terminals R/L1, S/L2 and T/L3 must be matched. If these terminals are not connected correctly, the converter does not operate properly.**
- **If the inverter is operated without connecting the terminals R/L1, S/L2 and T/L3 of the converter to the power supply, the converter will be damaged.**

(6) Wiring the power supply and inverter

Connect the inverter control power supply directly to the power supply without connecting a converter in between.





Cable gauge	0.75 to 2mm^2

NOTE

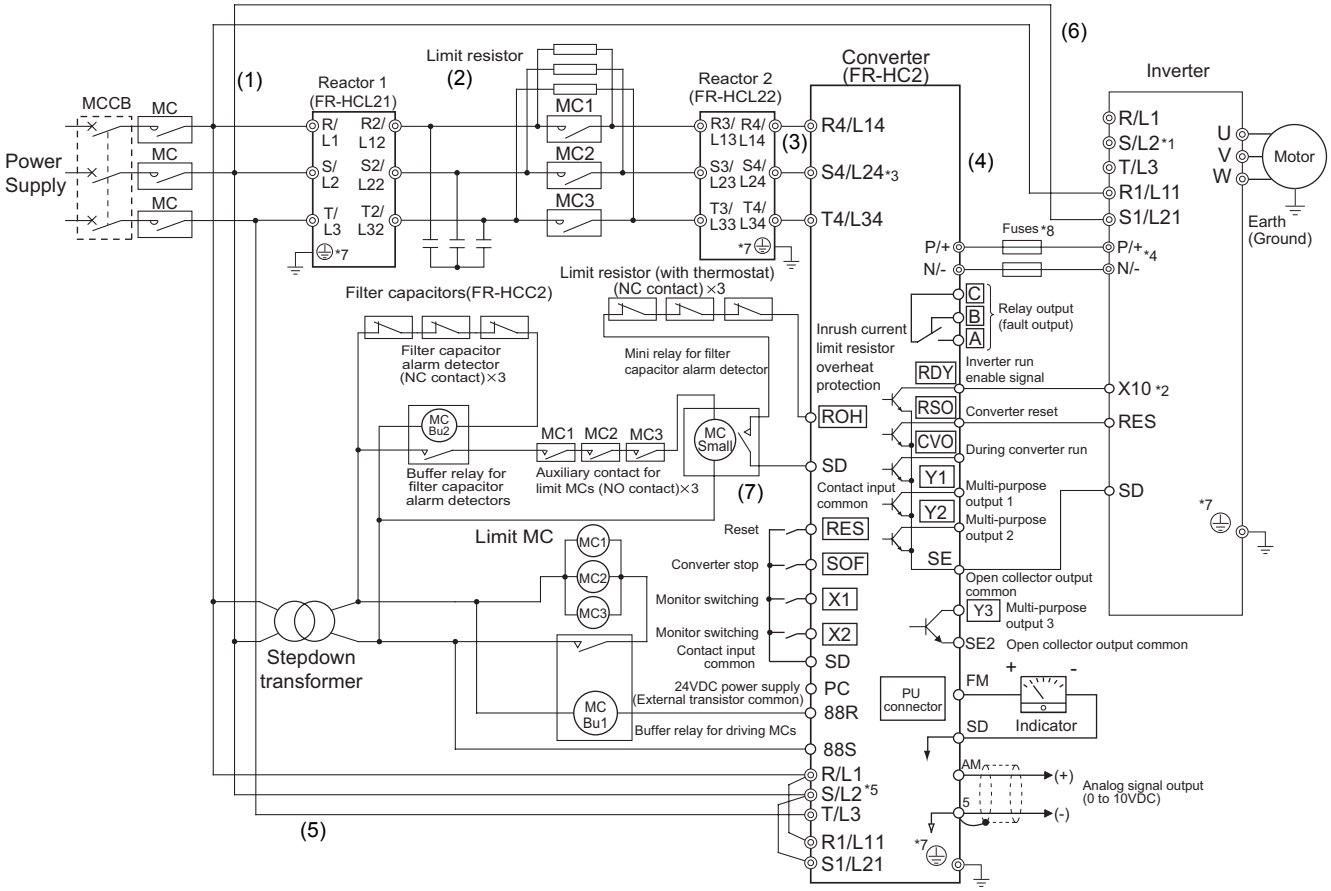
- **Refer to the inverter manual, and remove the jumpers across terminals R/L1 and R1/L11 and across terminals S/L2 and S1/L21 in the inverter main circuit.**
- **Always connect the power supply to the inverter. It supplies power to the inverter's control power and large-capacity cooling fan. If not connected, the inverter may come to a trip or be damaged.**

2.9 Wiring of main circuit (FR-HC2-H560K)

- Perform wiring securely to conform with the harmonic suppression guideline of the former Ministry of International Trade and Industry (currently the Japanese Ministry of Economy, Trade and Industry). Incorrect wiring causes the converter to display an alarm or causes an fault or damage.
- Refer to the Instruction Manual of each inverter for the wiring of the inverter. Special attention must be paid to the wiring length and wire gauge.

2.9.1 Connection diagram (when using with the FR-A700 series)

Connection method differs by the inverter series. Perform connection by referring to the Instruction Manual of the inverter.



∗1 Do not connect anything to the inverter power input terminals R/L1, S/L2, and T/L3. Incorrect connection will damage the inverter. Connecting opposite polarity of terminals P and N will damage the converter and the inverter.

∗2 Use input terminal function selection to assign the terminal used for X10 signal. (Refer to the Inverter Instruction Manual.)

∗3 The power phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched.

∗4 Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).

∗5 Always connect the terminal R, S, and T of the converter to the power supply. If the inverter is operated without connecting the terminals to the power supply, the converter will be damaged.

∗6 Do not insert MCCB or MC between (1) (terminal R/L1, S/L2, T/L3 input of the converter) and (3) (terminal R4/L14, S4/L24, T4/L34 input of the converter) of the above diagram. It will not operate properly (except for the limit MC).

∗7 Securely perform grounding (earthing) by using the grounding (earthing) terminal.

∗8 Installation of a fuse is recommended. *(Refer to page 11)*

Number	Wiring	Refer to page
(1)	Power supply and reactor 1	*46*
(2)	Reactor 1 and reactor 2	*46*
(3)	Reactor 2 and converter	*47*
(4)	Converter and inverter	*48*
(5)	Reactor 1 and converter	*48*
(6)	Power supply and inverter	*49*
(7)	Filter capacitor alarm detector and converter	*49* (Instruction Manual of the filter capacitor alarm detector)

NOTE

- **When connecting the converter to the inverter, match the control logic (sink logic (initial setting)/source logic). The converter does not operate properly if the control logic is different.**
  (*Refer to page 56* for the switching of the control logic. Refer to Inverter Instruction Manual for the switching of the control logic of the inverter.)
- **Keep the wiring length between terminals as short as possible.**
- **When sudden large distortion or depression of power supply occurs, reactor may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

⚠ CAUTION

⚠ Check the connection order of the reactor 1 and the reactor 2. Incorrect connection may damage the converter and reactors.

⚠ Always connect the terminal RDY of the converter to the terminal MRS or the inverter terminal of which X10 signal is assigned to. Also, always connect the terminal SE of the converter to the terminal SD of the inverter. If these are not connected, the converter may be damaged.

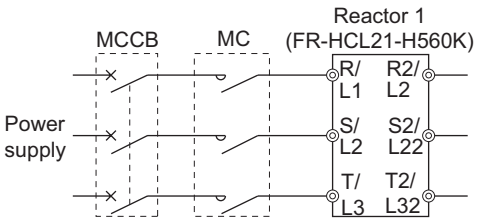
2.9.2 Wiring of main circuit

(1) Wiring power supply and reactor 1

- Use the cable shown in the below table for the connection.

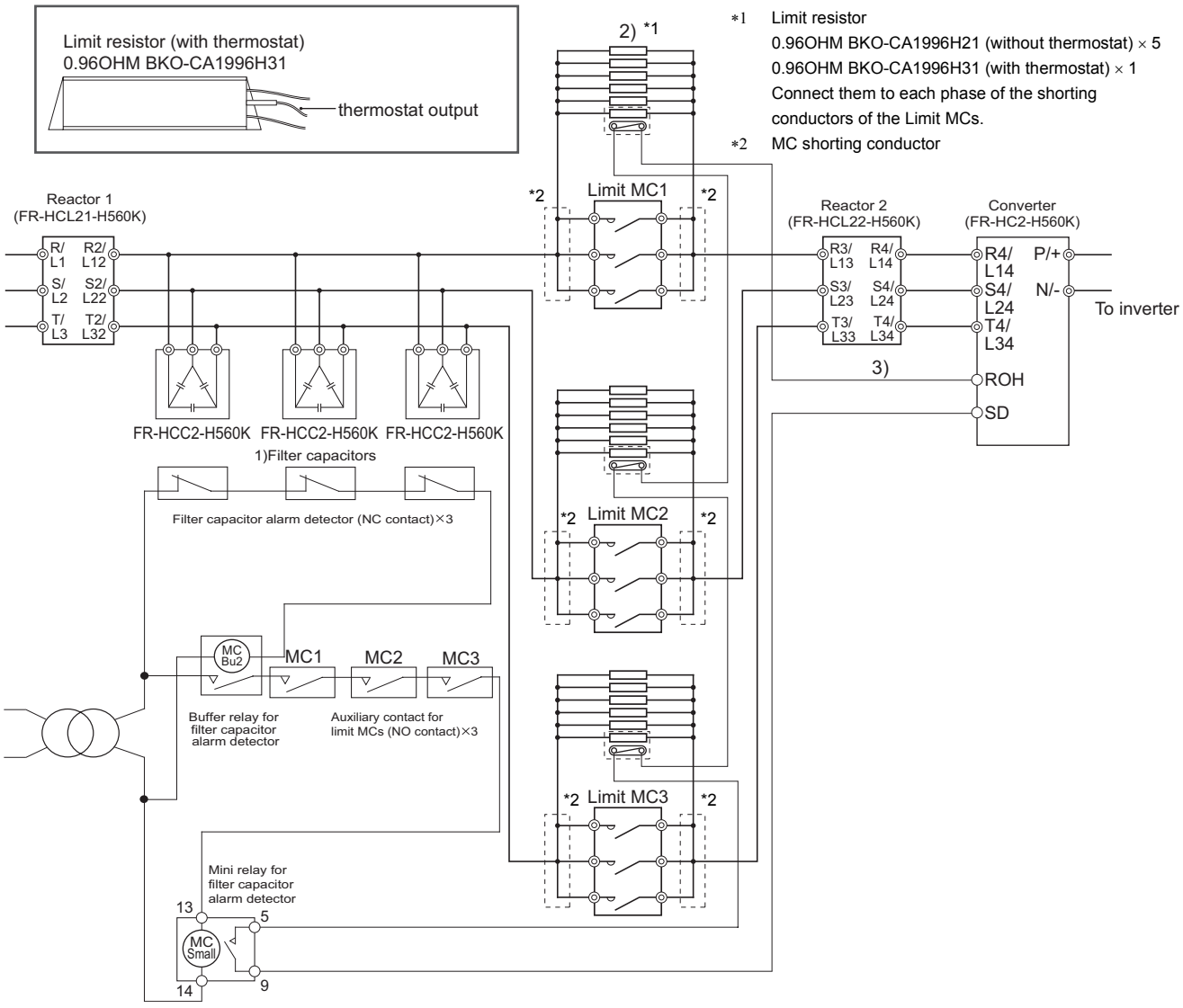
Cable gauge	2 × 250mm^2

- Use the moulded case circuit breaker (MCCB), the earth leakage circuit breaker (ELB) or the magnetic contactor shown in the below table.



Moulded Case Circuit Breaker (MCCB) or Earth Leakage Circuit Breaker (ELB) (NF or NV type)	1500A
Magnetic Contactor (MC)	S-N400 (3 in parallel)

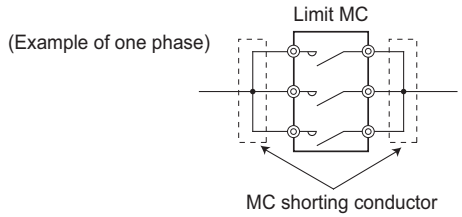
(2) Wiring reactor 1, filter capacitor, limit resistor, limit MC, and reactor 2



1) Filter capacitor
Install three filter capacitors in parallel to the output side of the reactor 1 or to the input side of the limit MC as shown in the above diagram.
Use the cable shown in the below table for the connection of filter capacitor.

Cable gauge	38mm^2
Wiring length	2m or less

2) Limit resistor, limit MC
Install a pair of a limit resistor and a limit MC to the output side of the reactor 1, and install another pair of those to the input side of the reactor 2.
Short three poles of the limit MC using the appended MC shorting conductors, and use that for one phase.
Before attaching an appended MC shorting conductor to a limit MC, remove the insulation barrier of the limit MC.
Connect six limit resistors in parallel to the shorting conductors of the limit MC at each phase. Apply a thermostat to at least one of the six limit resistors.



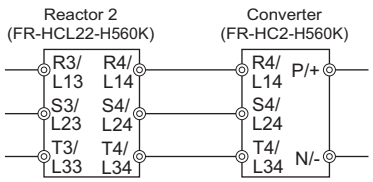
Use the cable shown in the below table for the connection of each phase between the reactor 1 and reactor 2.

Cable gauge	2 × 250mm^2
Total wiring length	10m or less

3) Connecting limit resistor thermostats to the converter
Wire the limit resistor thermostats in series at R-phase, S-phase, and T-phase so that the signals from the limit resistor thermostats are output into one line. In the wiring, also insert a mini relay so that the signal from the mini relay and the signals from the limit resistor thermostats are output to terminal ROH and SD of the converter as shown in the connection diagram on *page 46*.

(3) Wiring reactor 2 and converter

- Use the cable shown in the below table for the connection.

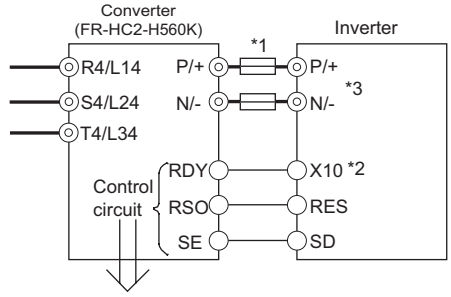


Cable gauge	2 × 250mm^2
Total wiring length	10m or less

(4) Wiring example of converter and inverter

- These units should be connected to transmit commands from the converter to the inverter securely.
  Connection method differs depending on the inverter series. Refer to the Instruction Manual of the inverter when connecting. Refer to the below table for the wiring length.

Across terminals P and P / terminals N and N	50m or less
Other control signal lines	30m or less



Wire gauge for the control circuit	0.75 to 2mm^2

∗1 Installation of a fuse is recommended to avoid the damage to spread in case of an inverter failure. Select a fuse according to the motor capacity. When using a motor, of which the capacity is smaller than the inverter capacity by two ranks or more, select the fuse capacity according to the inverter capacity. Refer to the fuse selection table on *page 12*.
When connecting several inverters, perform wiring with the wire gauge of the inverter's power supply side for terminal P/+ and N/-. *(Refer to the inverter manual.)*

∗2 The function of the inverter terminal, which is connected to the terminal RDY of the converter, needs to be set at the inverter side.

∗3 Refer to the Inverter Instruction Manual.
Do not insert MCCB between terminals P/+ and N/- (P and P, N and N).

NOTE

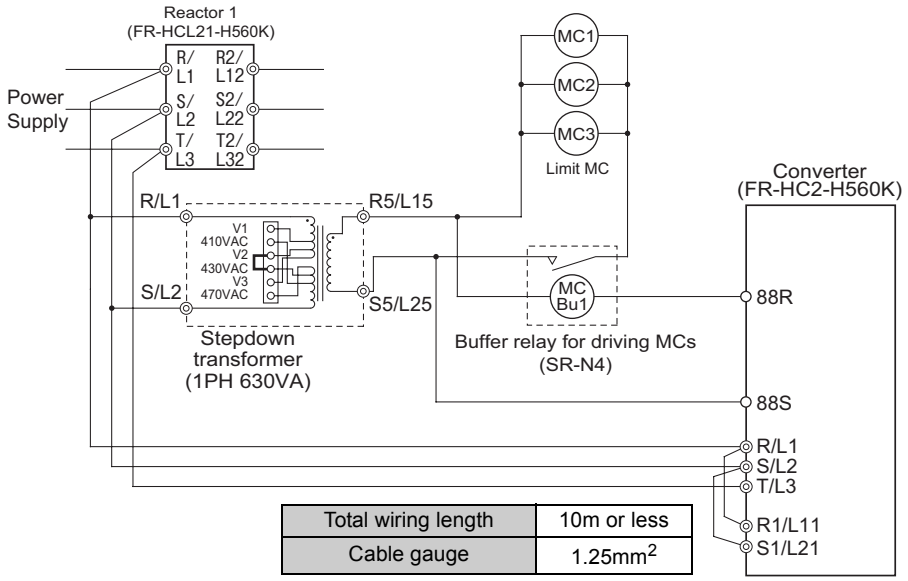
- **The converter operates as a common converter. Use terminals P/+ and N/- to connect it with the inverter. Do not connect anything to the inverter power input terminals R/L1, S/L2, and T/L3. Incorrect connection to the inverter power input will damage to the inverter. Connecting opposite polarity of terminals P/+ and N/- will damage the inverter and the converter.**
- **Do not connect the DC reactor to the inverter when using a high power factor converter.**

(5) Wiring reactor 1 and converter

Supply power to the power detecting terminals (R/L1, S/L2, T/L3) separately from the main circuit wiring.
Switch the tap (V1, V2, V3) of the stepdown transformer according to the input power supply voltage as shown in the below table.

Power Supply Voltage	Switching Tap Position
380V or more, less than 400V	V1
400V or more, 440V or less	V2
More than 440V, 460V or less	V3

Connect the MC start command terminals (88R, 88S) to the MC for the limit resistor (for three phases) through the buffer relay.



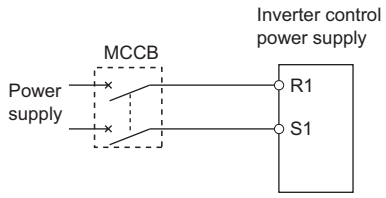
Total wiring length	10m or less
Cable gauge	1.25mm^2

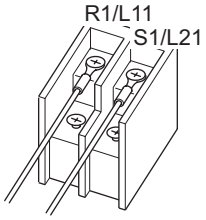
NOTE

- **The terminal R/L1, S/L2, and T/L3 of the converter are control terminals to detect power supply phases of the power supply. The voltage phases of the terminals R4/L14, S4/L24, and T4/L34 and the terminals R/L1, S/L2, and T/L3 must be matched. If these terminals are not connected correctly, the converter does not operate properly.**
- **If the inverter is operated without connecting the terminals R/L1, S/L2, and T/L3 of the converter to the power supply, the converter will be damaged.**

(6) Wiring the power supply and inverter

Connect the inverter control power supply directly to the power supply without connecting a converter in between.





Cable gauge	0.75 to 2mm^2

NOTE

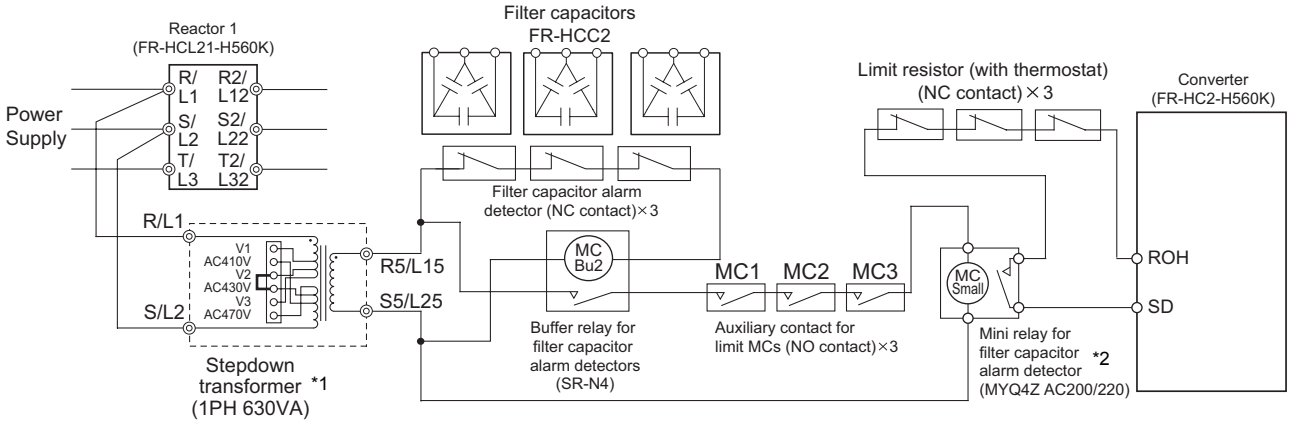
- **Refer to the inverter manual, and remove the jumpers across terminals R/L1 and R1/L11 and across terminals S/L2 and S1/L21 in the inverter main circuit.**
- **Always connect the power supply to the inverter. It supplies power to the inverter's control power and large-capacity cooling fan. If not connected, the inverter may come to a trip or be damaged.**

(7) Wiring filter capacitor alarm detector and converter

- Use the cable shown in the below table for the connection.

Cable gauge	2mm^2

Before wiring, read the Instruction Manual appended to the filter capacitor alarm detector carefully.



*1 Connect the wiring to the terminals R5/L15 and S5/L25 of the stepdown transformer by placing parallel with the wiring of *(5) Wiring reactor 1 and converter (Refer to page 48)*.

*2 Install the mini relay using the provided mini relay terminal block (PYF14T) and the mini relay clip (PYC-A1).

2.10 Notes on earthing (grounding)

- Always earth (ground) the converter and peripheral devices (reactor 1, reactor 2, outside box, filter capacitor).

1)Purpose of earthing (grounding)

Generally, an electrical apparatus has an earth (ground) terminal, which must be connected to the ground before use.
An electrical circuit is usually insulated by an insulating material and encased. However, it is impossible to manufacture an insulating material that can shut off a leakage current completely, and actually, a slight current flow into the case. The purpose of earthing (grounding) the case of an electrical apparatus is to prevent operator from getting an electric shock from this leakage current when touching it.
To avoid the influence of external noises, this earthing (grounding) is important to audio equipment, sensors, computers and other apparatuses that handle low-level signals or operate very fast.

2)Earthing (grounding) methods and earthing (grounding) work

As described previously, earthing (grounding) is roughly classified into an electrical shock prevention type and a noise-influenced malfunction prevention type. Therefore, these two types should be clearly distinguished, and the following work must be done to prevent the leakage current having the converter's high frequency components from entering the malfunction prevention type earthing (grounding):

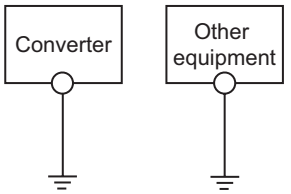
(a) Independently earth (ground) the converter and peripheral devices whenever possible. If independent earthing (grounding) (I) is not available, use (II) common earthing (grounding) in the figure below where the converter is connected with the other equipment at an earthing (grounding) point.
Do not use the other equipment's earthing (grounding) cable to earth (ground) the converter as shown in (III).
A leakage current containing many high frequency components flows into the earthing (grounding) cables of the converter and peripheral devices. Because of this, the converter must be earthed (grounded) separately from EMI-sensitive devices.
In a high building, it may be effective to use the EMI prevention type earthing (grounding) connecting to an iron structure frame, and electric shock prevention type earthing (grounding) with the independent earthing (grounding) together.

(b) This converter must be earthed (grounded). Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards).

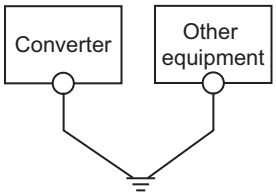
(c) Use the thickest possible earth (ground) cable. The earth (ground) cable size should be no less than the size indicated in the table on *page 29*.

(d) The converter and peripheral devices should have their earthing (grounding) points as close as possible to them, and their earthing (grounding) cables should be as short as possible.

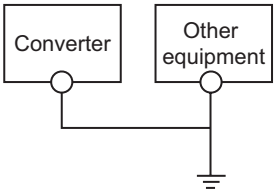
Run the earth (ground) cable as far away as possible from the I/O wiring of equipment sensitive to noises and run them in parallel in the minimum distance.



(I) Independent earthing (grounding).....Good



(II) Common earthing (grounding).....Good



(III) Common earthing (grounding) cable .....Not allowed

2.11 Compatible inverter for the high power factor converter

Refer to the table below for the compatible inverter capacities when connecting one inverter to a converter.

○: Compatible —: Not compatible*

Inverter capacity		2.2K or lower	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	75K
200V	FR-HC2-7.5K	—	○	○	○	Not applicable								
	FR-HC2-15K	—	—	—	○	○	○	Not applicable						
	FR-HC2-30K	—	—	—	—	—	○	○	○	○	Not applicable			
	FR-HC2-55K	—	—	—	—	—	—	—	—	○	○	○	○	Not applicable
	FR-HC2-75K	—	—	—	—	—	—	—	—	—	○	○	○	○

Inverter capacity		30K or lower	37K	45K	55K	75K	90K	110K	132K	160K	185K	200K	220K	250K
400V	FR-HC2-H75K	—	○	○	○	○	Not applicable							
	FR-HC2-H110K	—	—	—	○	○	○	○	Not applicable					
	FR-HC2-H280K	—	—	—	—	—	—	—	—	○	○	○	○	○
	FR-HC2-H560K	—	—	—	—	—	—	—	—	—	—	—	—	—

Inverter capacity		280K	315K	355K	375K	400K	450K	500K	530K	560K
400V	FR-HC2-H75K	Not applicable								
	FR-HC2-H110K	Not applicable								
	FR-HC2-H280K	○	Not applicable							
	FR-HC2-H560K	○	○	○	○	○	○	○	○	○

* When a non-applicable inverter is connected, the converter can be used as a common converter or a regenerative converter, but it's harmonic suppression effect reduces.

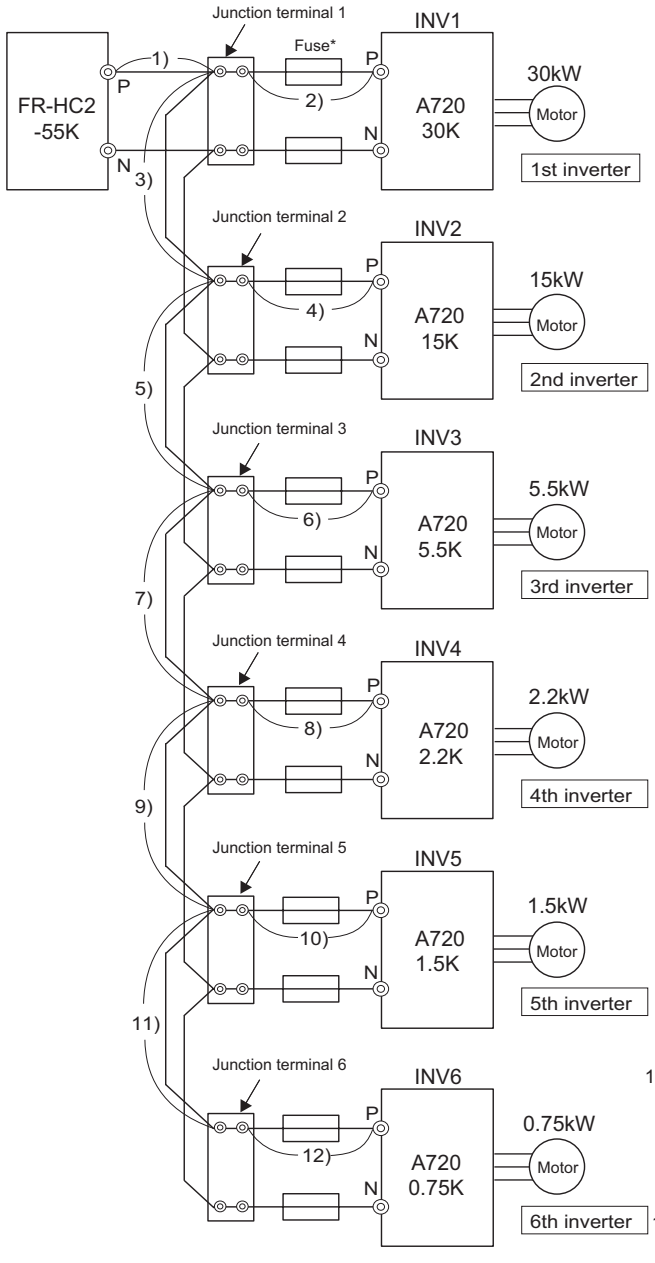
2.12 Wiring of several inverters to one converter

Up to ten inverters can be connected to one converter. Be sure to use a converter with the capacity higher than the total capacities of inverters. Additionally, the total capacity of the inverters needs to be higher than half the converter capacity.
If the total inverter capacity is less than half the converter capacity, the converter can be used as a common converter or a regenerative converter. However, it's harmonic suppression effect reduces.

(1) Junction terminals or cross wiring are used to connect several inverters, so carefully select the wire gauge. Start adding the inverter capacities from the furthest inverter.
(2) When connecting several inverters, connect starting with the inverter with the highest capacity.
(3) Installation of a fuse, which corresponds with each motor capacity, is recommended for each inverter when connecting several inverters to one converter. Select a fuse according to the motor capacity.
When using a motor, of which capacity is smaller than the inverter capacity by two ranks or more, select the converter capacity according to the inverter capacity. *(Refer to page 11 and 12.)*
(4) Keep the total wiring length within 50m.

●Main circuit wiring example

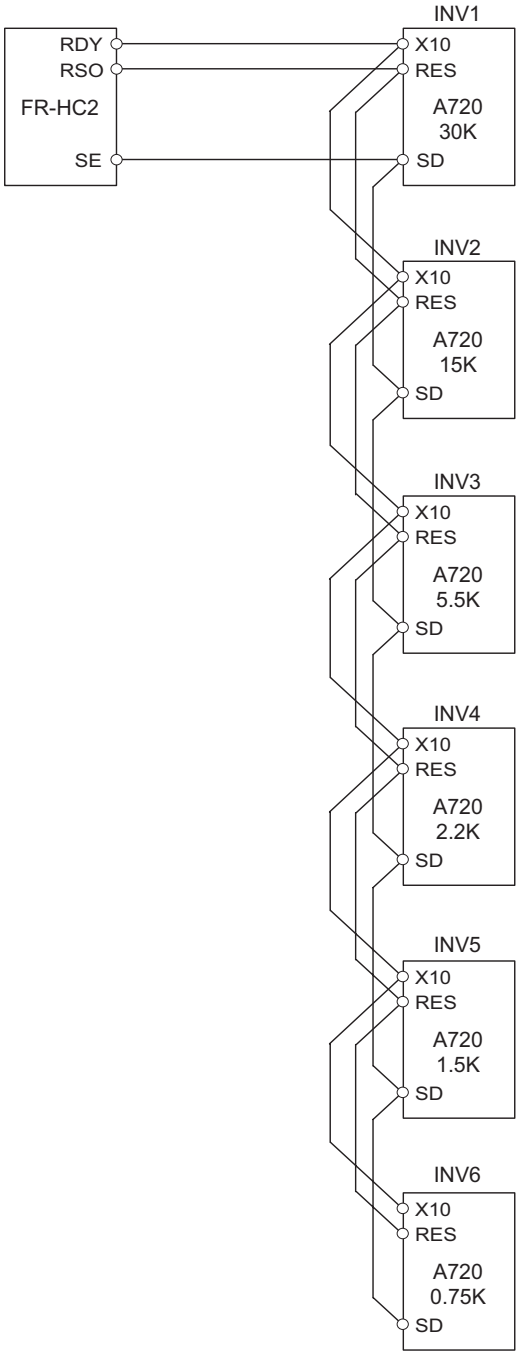
The following diagram shows a connection example when connecting six inverters in total (FR-A720-30K, 15K, 5.5K, 2.2K, 1.5K, and 0.75K) to FR-HC2-55K.



1) Wire gauge between FR-HC2 and the junction terminal 1 is 100mm^2 according to the FR-HC2 capacity.
2) Wire gauge between the junction terminal 1 and the inverter is 60mm^2 because the inverter capacity is 30K.
3) Wire gauge between the junction terminal 1 and junction terminal 2 can be calculated as follows: 15+5.5+2.2+1.5+0.75=24.95K, and 24.95K rounds up to 30K, so the wire gauge is 60mm^2.
4) The Wire gauge between the junction terminal 2 and the inverter is 22mm^2 because the inverter capacity is 15K.
5) Wire gauge between the junction terminal 2 and junction terminal 3 can be calculated as follows: 5.5+2.2+1.5+0.75=9.95K, and 9.95K rounds up to 11K, so the wire gauge is 14mm^2.
6) Wire gauge between the junction terminal 3 and the inverter is 14mm^2 because the inverter capacity is 5.5K.
7) Wire gauge between the junction terminal 3 and junction terminal 4 can be calculated as follows: 2.2+1.5+0.75=4.45K, and 4.45 K rounds up to 5.5K, so the wire gauge is 5.5mm^2.
8) Wire gauge between the junction terminal 4 and the inverter is 2mm^2 because the inverter capacity is 2.2K.
9) Wire gauge between the junction terminal 4 and junction terminal 5 can be calculated as follows: 1.5+0.75=2.25K, and 2.25K rounds down to 2.2K, so the wire gauge is 2mm^2.
10) Wire gauge between the junction terminal 5 and the inverter is 2mm^2 because the inverter capacity is 1.5K.
11) Wire gauge between the junction terminal 5 and junction terminal 6 is 2mm^2 because the inverter capacity is 0.75K.
12) Wire gauge between the junction terminal 6 and the inverter is 2mm^2 because the inverter capacity is 0.75K.

* When installing several fuses in parallel, leave 12mm or more between the fuses.

●Example of control circuit wiring



- For the control circuit wiring, use shielded or twisted wires, and separate the wire from the main circuit and high-voltage circuits.
- Keep the total wiring length within 30m.

2.13 Wiring of control circuit

2.13.1 Description of control circuit terminal

indicates that terminal functions can be selected using *Pr. 3 to Pr. 7 (input terminal function selection) and Pr. 11 to Pr. 16 (output terminal function selection)(Refer to page 72, 74)*

(1) Input signal

Type	Terminal Symbol	Terminal Name	Description		Rated Specifications
Contact input	RES	Reset	Used to reset fault output provided when a fault occurs. Turn ON the RES signal for more than 0.1s, then turn it OFF.		Input resistance : 4.7kΩ Voltage at opening: 21 to 27VDC Contacts at short-circuited: 4 to 6mADC
	SOF	Converter stop	Turning ON the SOF signal stops the converter. RDY signal turns OFF, limit MC turns ON		
	ROH	Inrush current limit resistor overheat protection	200V class 7.5K to 75K 400V class 75K, 110K	Connect this terminal to terminal ROH1 of the outside box (FR-HCB2). The ROH signal is input to stop the converter operation when the limit resistor may overheat.	
			400V class 280K, 560K	An auxiliary contact (NO contact) of a limit resistor MC, a limit resistor (with thermostat) (NC contact), and a filter capacitor alarm detector (NC contact, 560K only) are connected to stop the converter operation when overheating of the limit resistor becomes a concern and when a filter capacitor is faulty.	
	X1 X2	Monitor switching	FM and AM output or PU monitor display can be switched by a combination of ON/OFF of X1 signal and X2 signal.		
	SD	Contact input common (sink) (initial setting)	Common terminal for contact input terminal (sink logic) and terminal FM.		—
		External transistor common (source)	When connecting the transistor output (open collector output), such as a programmable controller in source logic, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.		
		24VDC power supply common	Common output terminal for 24VDC 0.1A power supply (terminal PC). Isolated from terminals 5, SE and SE2.		
	PC	External transistor common (sink) (initial setting)	When connecting the transistor output (open collector output), such as a programmable controller in sink logic, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.		Power supply voltage range 19.2 to 28.8VDC Permissible load current 100mA
		Contact input common (source)	Common terminal for contact input terminal (source logic)		
		24VDC power supply	Can be used as 24VDC 0.1A power supply.		

(2) Output signal

Type	Terminal Symbol	Terminal Name	Description	Rated Specifications
Open collector	RDY	Inverter run enable signal	Turns ON at alarm occurrence and reset (RES) signal input. Connect this terminal to the terminal MRS or a terminal where the X10 signal is assigned to in the inverter. Turning ON RDY signal stops the inverter. RYD signal OFF: Inverter can run RYD signal ON: Inverter cannot run	Permissible load 24VDC (27VDC maximum) 0.1A (A voltage drop is 2.8V maximum when the signal is ON.)
	CVO	During converter run	Signal is output during harmonic suppression.	
	Y1	Multi-purpose output 1	Output item: OL signal (overload alarm) (initial setting) Turns ON at an occurrence of overcurrent (150% overload or more).	
	Y2	Multi-purpose output 2	Output item: PHS signal (power phase detection) (initial setting) Turns ON when power phase detection is locked.	
	RSO	Converter reset	Turns ON at a converter reset (RES-ON). Connect this terminal to the inverter terminal of which RES signal is assigned to. Reset the connected inverter by turning ON the RSO.	
	SE	Open collector output common	Common terminal for the terminals RDY, CVO, OL, Y1, Y2 Connect it to the inverter terminal SD (sink logic).	—
Pulse	FM	For meter	Select one monitor item from multiple monitor items such as input current and bus voltage. Not output during a converter reset.	Permissible load current 2mA At rated input current of the converter: 1440 pulses/s
Analog	AM	Analog signal output	The output signal is proportional to the magnitude of the corresponding monitoring item. Monitor item can be switched by ON/OFF of terminals X1 and X2.	Output signal 0 to 10VDC Permissible load current 1mA Load impedance 10k
	5	Analog signal output common	Common terminal for analog signal output	—
Relay	A, B, C	Fault contact	1 changeover contact output indicates that the converter's protective function is activated and the output is stopped. Fault: No conduction across B and C (Conduction across A and C), Normal: Conduction across B and C (No conduction across A and C)	Contact capacity AC230V 0.3A (Power factor=0.4) 30VDC output 0.3A
	88R, 88S	MC connection terminal	Controls the MC for the limit resistor.	—

(3) Output signals of FR-HC2 dedicated board

Type	Terminal Symbol	Terminal Name	Description	Rated Specifications
Open collector	Y3	Multi-purpose output 3	Output item: Y5 signal (output voltage match) (initial setting) Turns ON when the detected bus voltage equals to the commanded bus voltage.	Permissible load: 24VDC 0.1A
	SE2	Open collector output common	Common terminal for terminal Y3	—

(4) Communication *

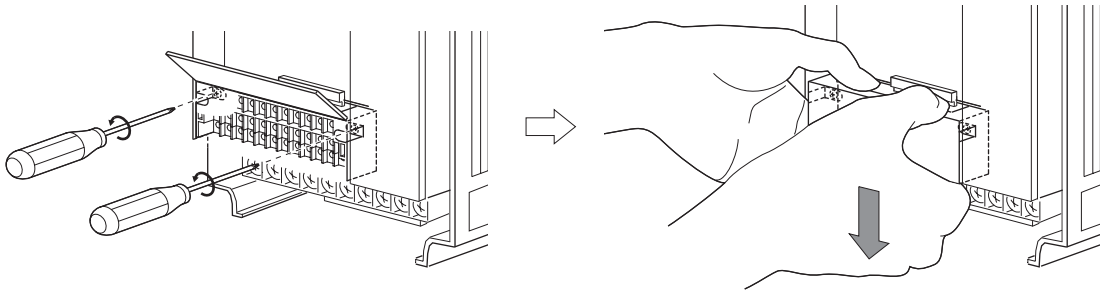
Type	Terminal Symbol	Terminal Name	Description	Refer to page
RS-485	—	PU connector	With the PU connector, communication can be made through RS-485. (for connection on a 1:1 basis only) •Conforming standard : EIA-485 (RS-485) •Transmission format : Multidrop •Communication speed : 4800 to 38400bps •Overall length : 500m	*91*

* USB connector and RS-485 terminal block cannot be used.

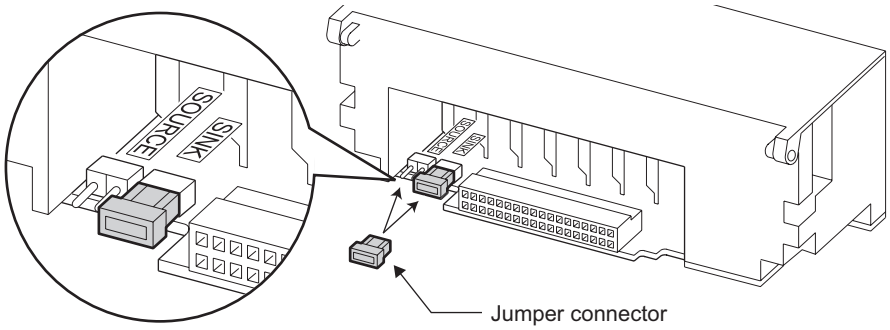
2.13.2 Changing the control logic

The input signals are set to sink logic (SINK) when shipped from the factory.
To change the control logic, the jumper connector on the back of the control terminal must be moved to the other position.
(The output signals may be used in either the sink or source logic independently of the jumper connector position.)

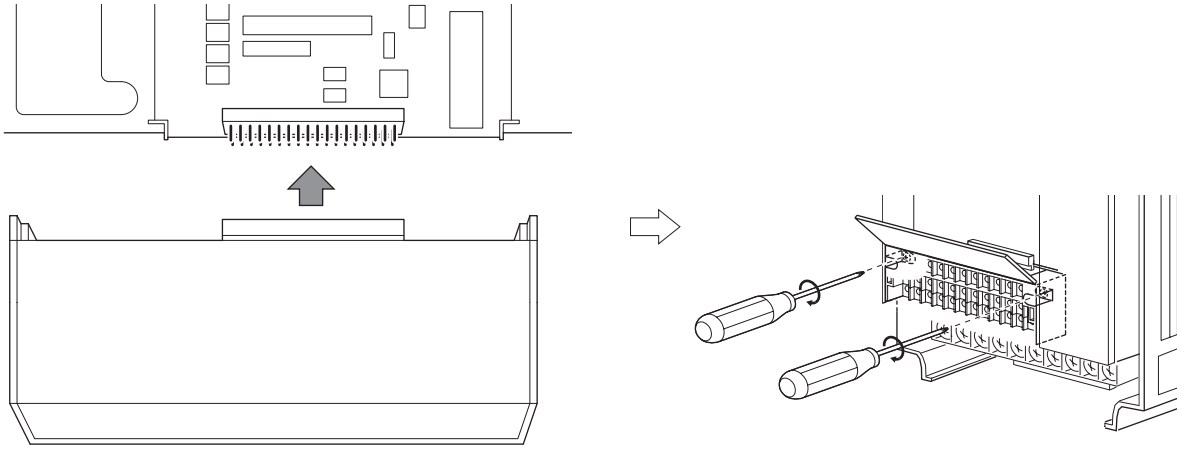
(1) Loosen the two installation screws at the both side of the control circuit terminal block. (These screws cannot be removed.)
Slide down the standard control circuit terminal block to remove it.



(2) Change the jumper connector set to the sink logic (SINK) on the rear panel of the control circuit terminal block to the source logic (SOURCE).



(3) Using care not to bend the pins of the converter's control circuit connector, reinstall the control circuit terminal block and fix it with the installation screws.



NOTE

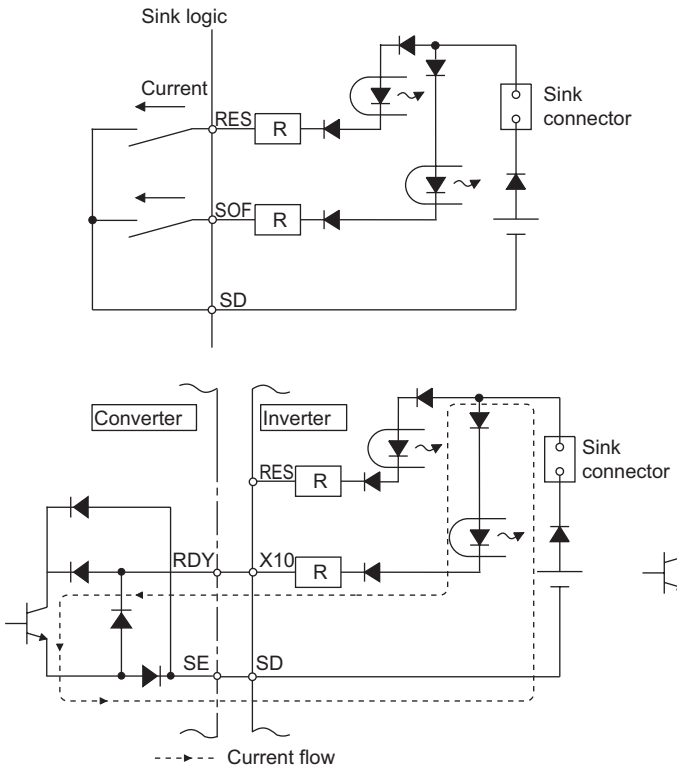
1. **Make sure that the control circuit connector is installed correctly.**
2. **While power is ON, never disconnect the control circuit terminal block.**

(4) Sink logic and source logic

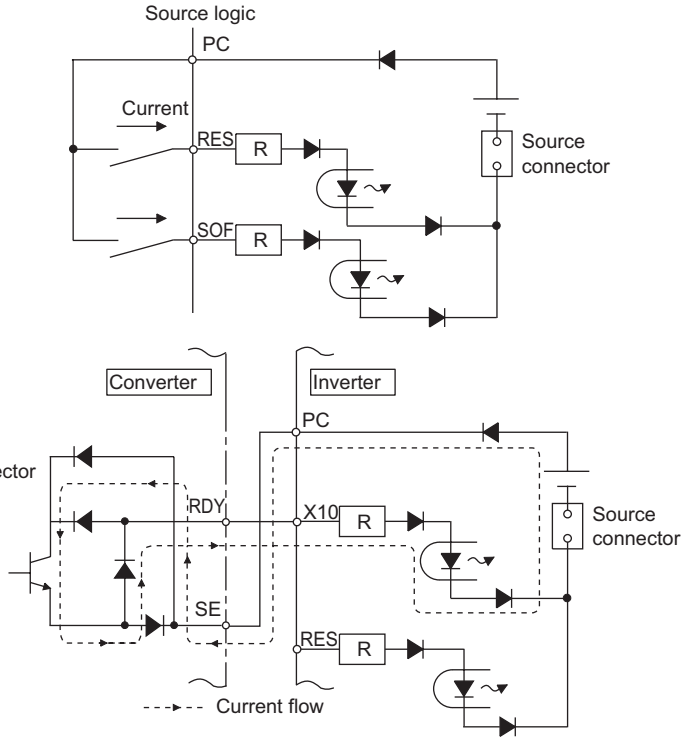
•In the sink logic, a signal switches ON when a current flows from the corresponding signal input terminal.
Terminal SD is common to the contact input signals. Terminal SE is common to the open collector output signals.

•In the source logic, a signal switches ON when a current flows into the corresponding signal input terminal.
Terminal PC is common to the contact input signals. Terminal SE is common to the open collector output signals.

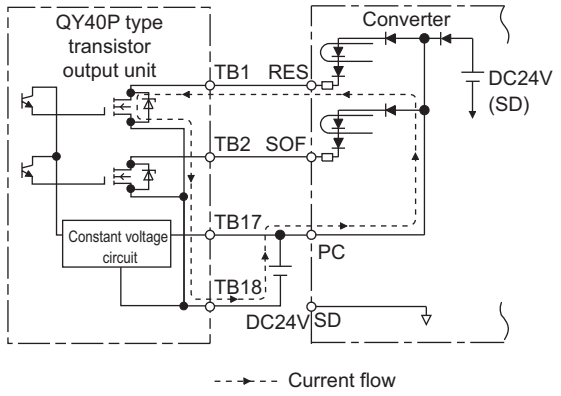
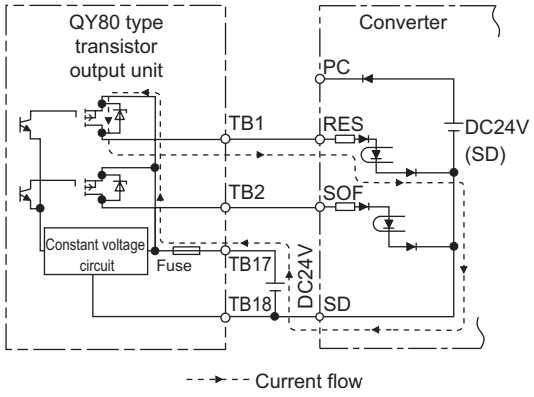
● Current flow concerning the input/output signal when sink logic is selected



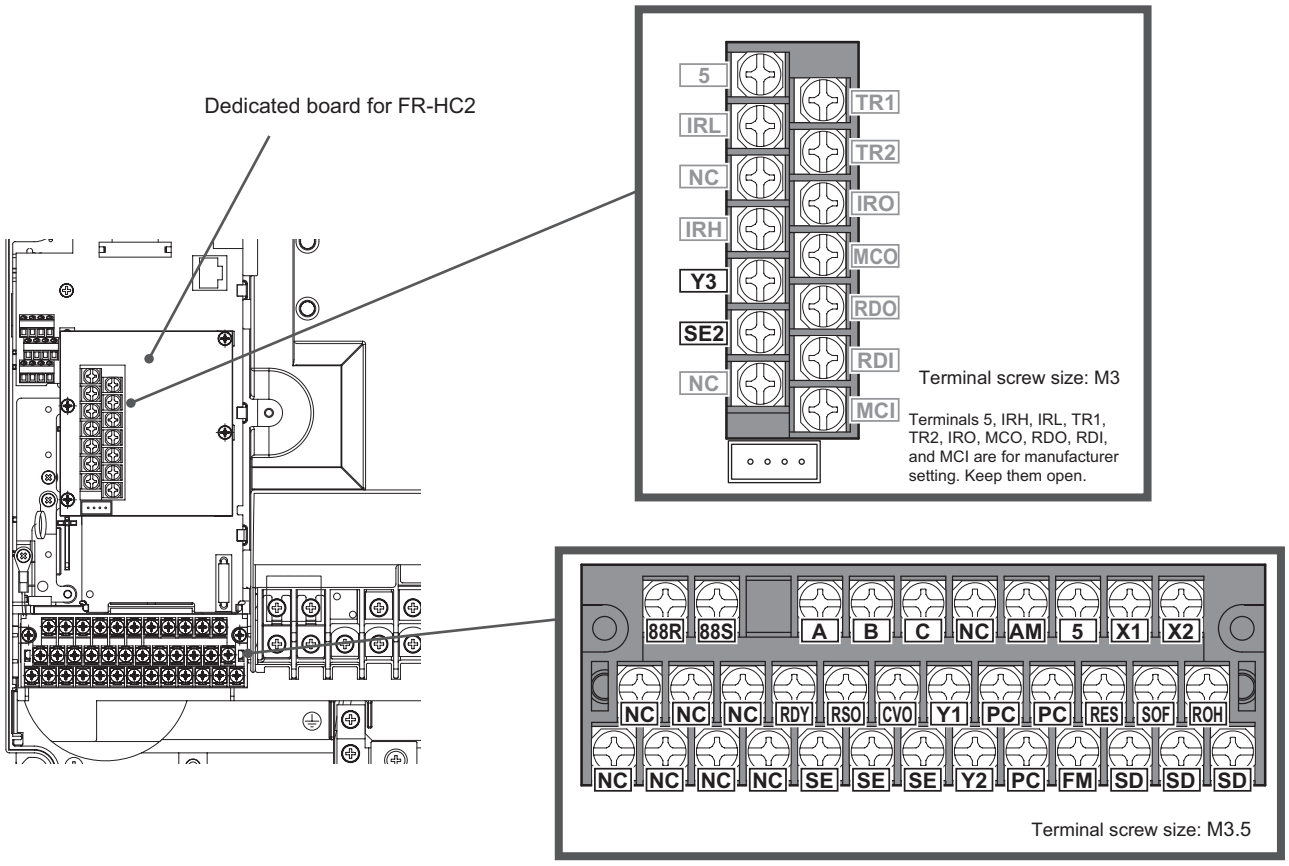
● Current flow concerning the input/output signal when source logic is selected



●When using an external power supply for transistor output

• Sink logic type Use terminal PC as a common terminal, and perform wiring as shown below. (Do not connect terminal SD of the converter with the terminal 0V of the external power supply. When using terminals PC and SD as a 24VDC power supply, do not install an external power supply in parallel with the converter. Doing so may cause a malfunction in the inverter due to undesirable currents.)	• Source logic type Use terminal SD as a common terminal, and perform wiring as shown below. (Do not connect terminal PC of the converter with the terminal +24V of the external power supply. When using terminals PC and SD as a 24VDC power supply, do not install an external power supply in parallel with the converter. Doing so may cause a malfunction in the inverter due to undesirable currents.)
	

2.13.3 Control circuit terminal layout



(1) Common terminals of the control circuit (SD, 5, SE, SE2)

Terminals SD, 5, SE, and SE2 are all common terminals (0V) for I/O signals and are isolated from each other. Do not earth (ground) these terminals.

Avoid connecting the terminal SD and 5 and the terminal SE and 5.

Terminal SD is a common terminal for the contact input terminals (RES, SOF, X1, X2, ROH) and frequency output signal (FM). The open collector circuit is isolated from the internal control circuit by photocoupler.

Terminal 5 is a common terminal for the analog output terminal AM. It should be protected from external noise using a shielded or twisted cable.

Terminal SE is a common terminal for the open collector output terminal (RDY, RSO, CVO, Y1, Y2). The contact input circuit is isolated from the internal control circuit by photocoupler.

Terminal SE2 is a common terminal for the open collector output terminal (Y3). The contact input circuit is isolated from the internal control circuit by photocoupler.

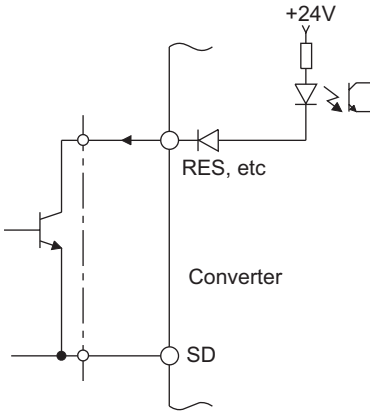
Do not connect anything to the free terminal (NC) of the control circuit.

⚠ CAUTION

⚠ Do not connect anything to the free terminal (NC) of the control circuit.
Using the terminal may cause a damage to the converter and the inverter.

(2) Signal inputs by contactless switches

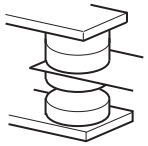
The contacted input terminals of the converter (RES, SOF, X1, X2, ROH) can be controlled using a transistor instead of a contacted switch as shown on the right.



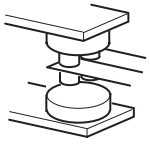
External signal input using transistor

2.13.4 Wiring instructions

1) It is recommended to use the cables of 0.75mm^2 gauge for connection to the control circuit terminals.
   If the cable gauge used is 1.25mm^2 or more, the front cover may be lifted when there are many cables running or the cables are run improperly, resulting in an operation panel contact fault.
2) The wiring length should be 30m (200m for the terminal FM) at the maximum.
3) Use shielded or twisted cables for connection to the control circuit terminals and place them away from the main and power circuits (including the 200V relay sequence circuit).
4) Use two or more parallel micro-signal contacts or twin contacts to prevent a contact faults when using contact inputs since the control circuit input signals are micro-currents.



Micro signal contacts

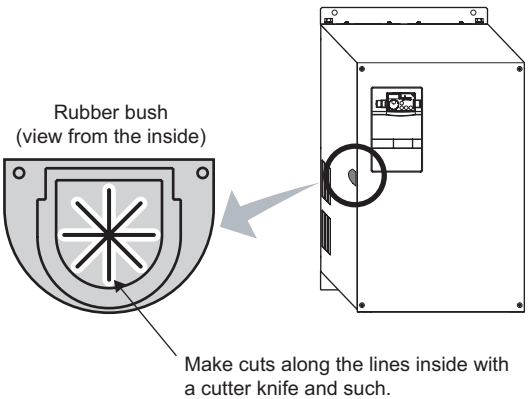


Twin contacts

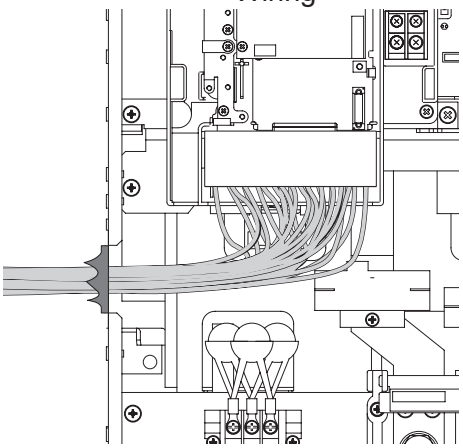
5) Do not apply a voltage to the contact input terminals (e.g. RES) of the control circuit.
6) Always use relay coil, lamp, etc. for fault output terminals (A, B, C).

- **Wiring of the control circuit of the 75K or higher**

  Separate the wiring of the control circuit away from the wiring of the main circuit.
  Make cuts in rubber bush of the converter side and lead wires.



<Wiring>



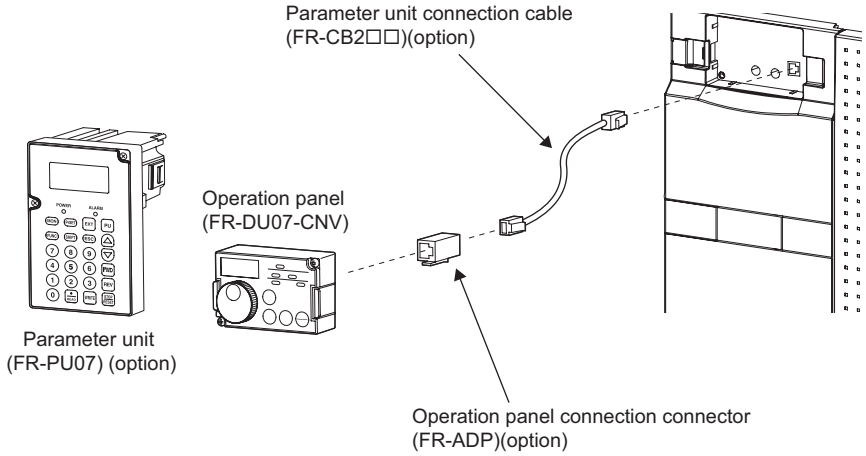
⚠ CAUTION

⚠ Do not connect anything to the free terminal (NC) of the control circuit.
Using the terminal may cause a damage to the converter and the inverter.

⚠ Always connect the terminal RDY of the converter to the terminal MRS or the inverter terminal of which X10 signal is assigned to. Also, always connect the terminal SE of the converter to the terminal SD of the inverter. If these are not connected, the converter may be damaged.

2.13.5 When connecting the operation panel or parameter unit using a connection cable

Having an operation panel on the enclosure surface is convenient. With a connection cable, you can mount the operation panel (FR-DU07-CNV) or parameter unit (FR-PU07) to the enclosure surface, and connect it to the converter.



REMARKS

•Refer to the following when fabricating the cable on the user side. Keep the total cable length within 20m.
Product available on the market (as of Jan. 2010)

	Name	Model Name	Manufacturer
1)	Communication cable	SGLPEV-T (Cat5e/300m) 24AWG × 4P	Mitsubishi Cable Industries, Ltd.
2)	RJ-45 connector	5-554720-3	Tyco Electronics

2.13.6 Communication operation (computer link operation)

Using the PU connector, you can perform communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can monitor the converter or read and write to parameters.
For further details, *refer to page 91*.

NOTE

- **RS-485 terminal block and USB connector on the control circuit board cannot be used. Do not connect anything to these.**

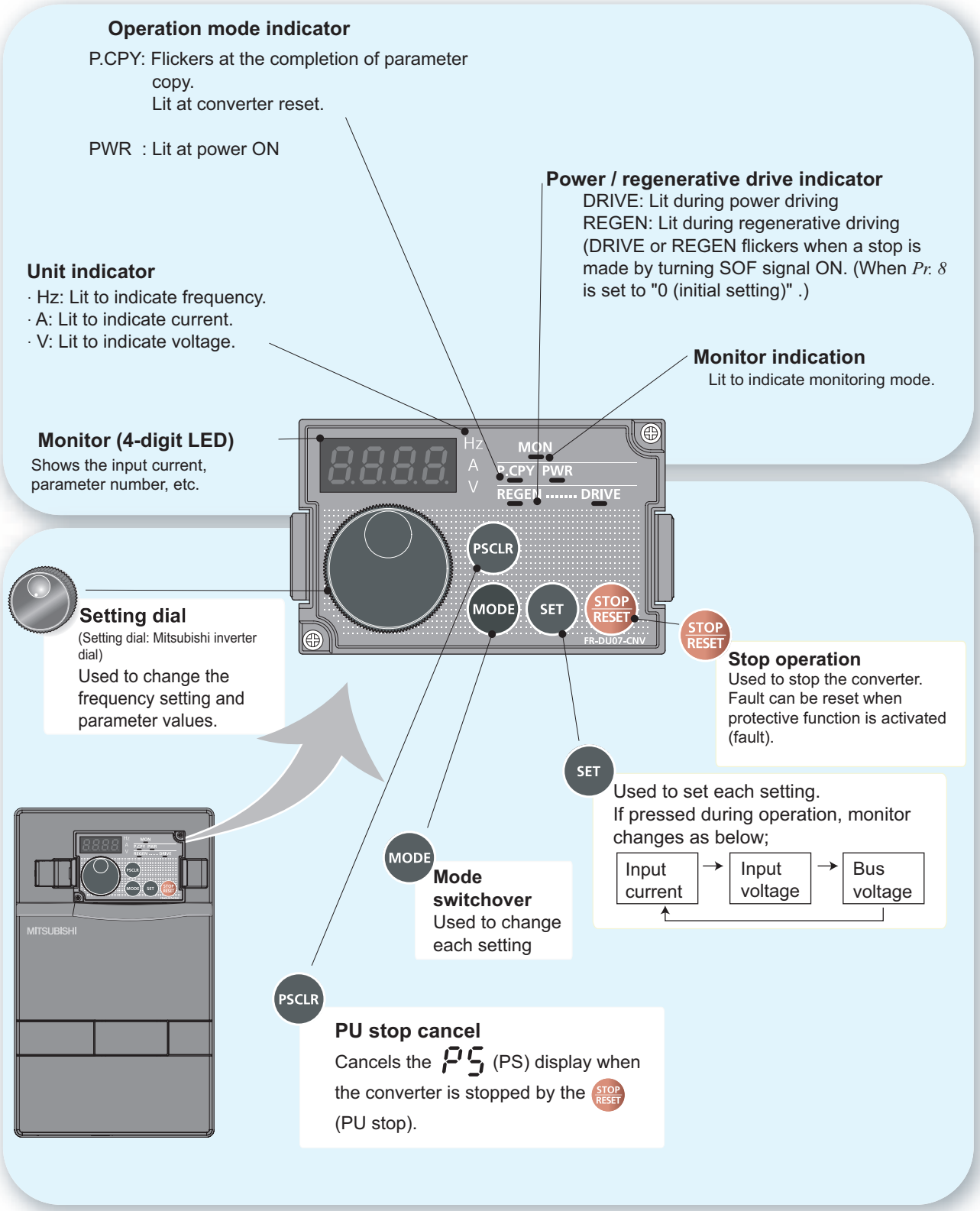
3 PARAMETERS

This chapter provides the "PARAMETERS" of this product. Always read the instructions before using the equipment.

3.1 Operation panel (FR-DU07-CNV) 62
3.2 Parameter unit (FR-PU07), parameter unit with battery pack (FR-PU07BB(-L)) 65
3.3 Parameter list 69
3.4 Description of parameters 71
3.5 Parameter clear / All parameter clear 117
3.6 Parameter copy and parameter verification 118

3.1 Operation panel (FR-DU07-CNV)

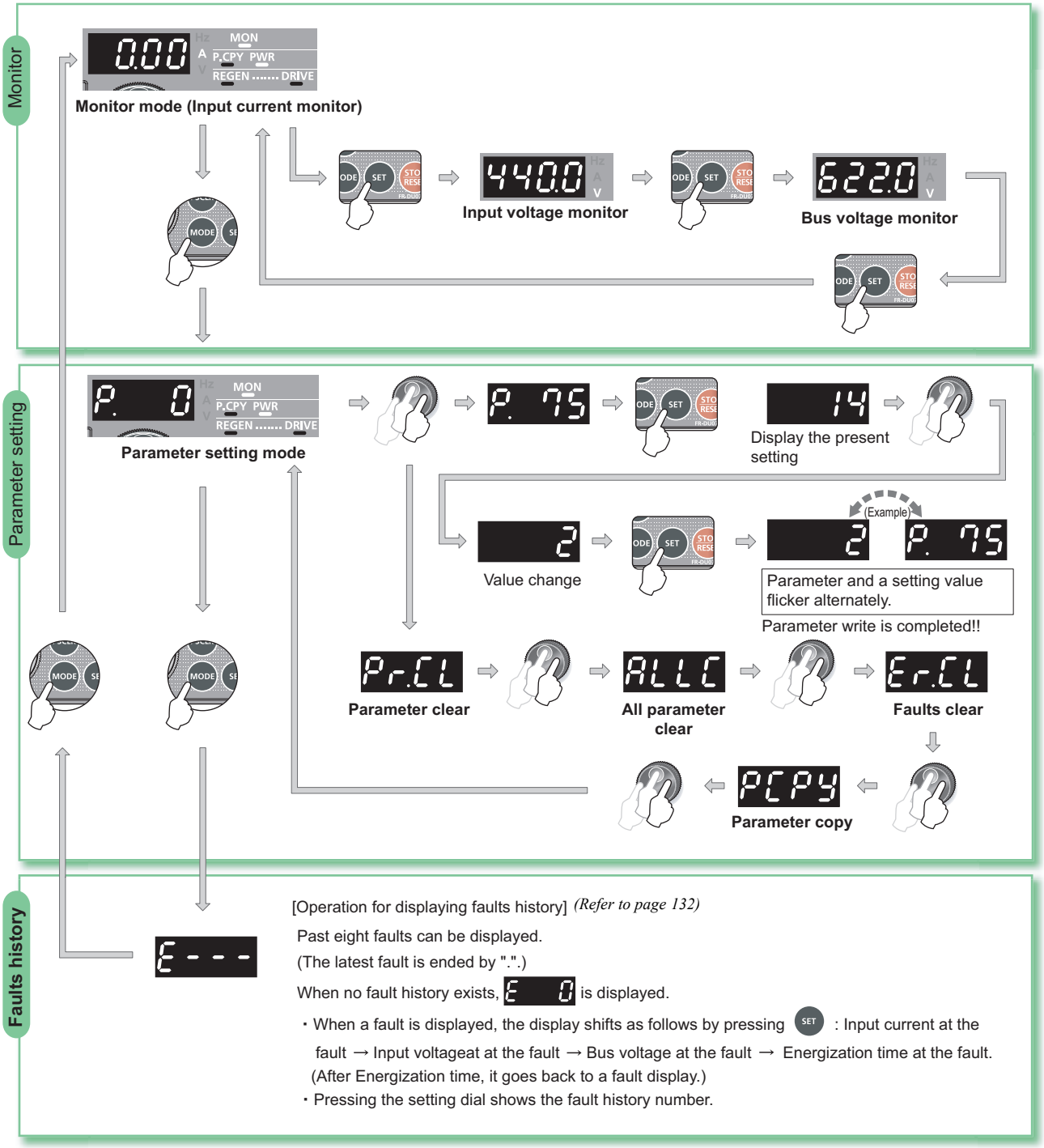
3.1.1 Names and functions of the operation panel (FR-DU07-CNV)


Operation mode indicator
P.CPY: Flickers at the completion of parameter copy.
Lit at converter reset.
PWR : Lit at power ON
Power / regenerative drive indicator
DRIVE: Lit during power driving
REGEN: Lit during regenerative driving
(DRIVE or REGEN flickers when a stop is made by turning SOF signal ON. (When Pr. 8 is set to "0 (initial setting)" .)
Unit indicator
· Hz: Lit to indicate frequency.
· A: Lit to indicate current.
· V: Lit to indicate voltage.
Monitor indication
Lit to indicate monitoring mode.
Monitor (4-digit LED)
Shows the input current, parameter number, etc.
Hz
A
V
MON
P.CPY
PWR
REGEN
DRIVE
PSCLR
MODE
SET
STOP RESET
FR-DU07-CNV
Setting dial
(Setting dial: Mitsubishi inverter dial)
Used to change the frequency setting and parameter values.
Stop operation
Used to stop the converter. Fault can be reset when protective function is activated (fault).
SET
Used to set each setting.
If pressed during operation, monitor changes as below;
Input current
Input voltage
Bus voltage
MODE
Mode switchover
Used to change each setting
PSCLR
PU stop cancel
Cancels the PS (PS) display when the converter is stopped by the STOP RESET (PU stop).
MITSUBISHI

REMARKS

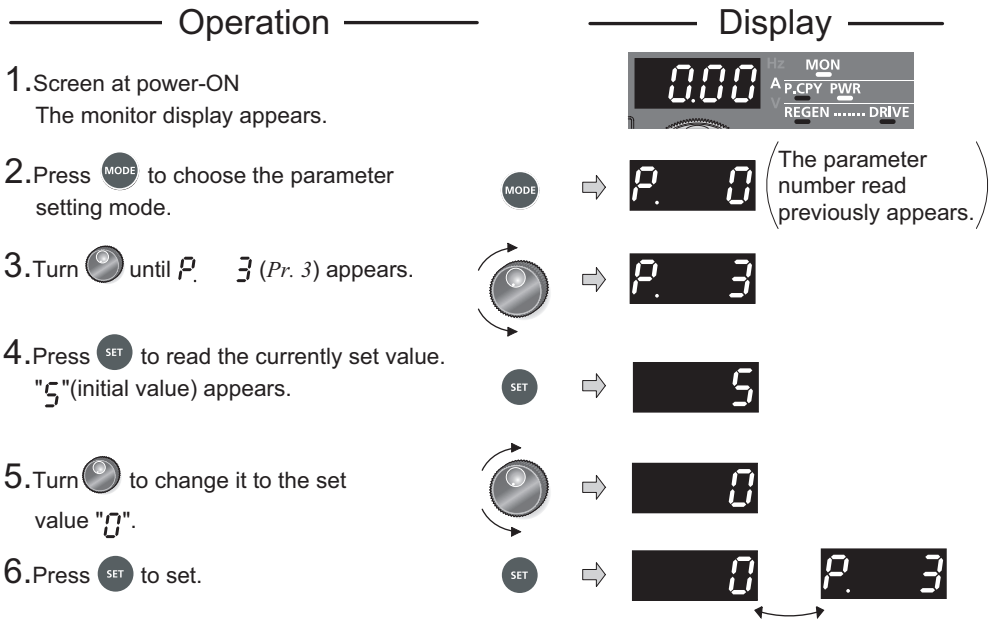
FR-DU07-CNV cannot be used with the inverter. If FR-DU07-CNV is connected to an inverter, "Err." flickers.

3.1.2 Basic operation (factory setting)


Monitor
Monitor mode (Input current monitor)
Input voltage monitor
Bus voltage monitor
Parameter setting
Parameter setting mode
Display the present setting
Value change
(Example)
Parameter and a setting value flicker alternately.
Parameter write is completed!!
Parameter clear
All parameter clear
Faults clear
Parameter copy
Faults history
[Operation for displaying faults history] (Refer to page 132)
Past eight faults can be displayed.
(The latest fault is ended by ".".)
When no fault history exists, E 0 is displayed.
・When a fault is displayed, the display shifts as follows by pressing SET : Input current at the fault → Input voltageat the fault → Bus voltage at the fault → Energization time at the fault.
(After Energization time, it goes back to a fault display.)
・Pressing the setting dial shows the fault history number.

3.1.3 Changing the parameter setting value

Changing example | Change the *Pr. 3 ROH terminal function selection* setting.


Operation
Display
1.Screen at power-ON
The monitor display appears.
2.Press MODE to choose the parameter setting mode.
3.Turn until P. 3 (Pr. 3) appears.
4.Press SET to read the currently set value.
"5"(initial value) appears.
5.Turn to change it to the set value "0".
6.Press SET to set.
MON
P.CPY PWR
REGEN ..... DRIVE
The parameter number read previously appears.
Flicker ··· Parameter setting complete!!

· By turning , you can read another parameter.

· Press SET to show the setting again.

· Press SET twice to show the next parameter.

· Press MODE twice to return the monitor to input current monitor.

? Er 1 ~ Er 4 is displayed... Why?

☞ Er 1 appears ..... Write disable error

Er2 appears..... Write error during operation

For details, refer to page *124*.

REMARKS

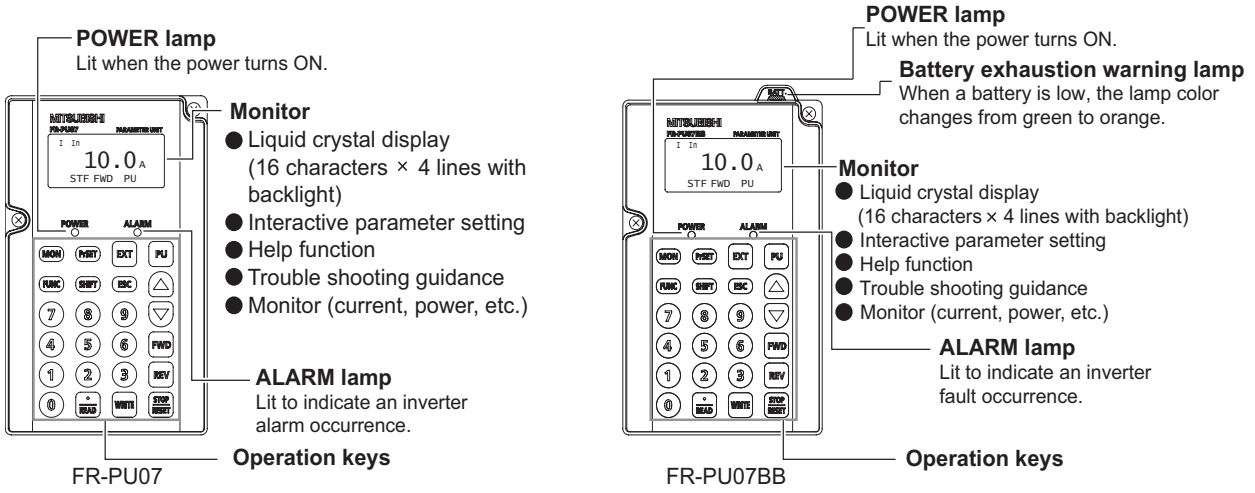
- The number of digits displayed on the operation panel (FR-DU07-CNV) is four. Only the upper four digits of values can be displayed and set. If the values to be displayed have five digits or more including decimal places, the fifth or later numerals can not be displayed nor set.

3.2 Parameter unit (FR-PU07), parameter unit with battery pack (FR-PU07BB(-L))

Parameter setting and monitor display can be performed by connecting the parameter unit (FR-PU07) or the parameter unit with battery pack (FR-PU07BB(-L)*) to the converter. Note that their functions are limited compared to when they are used with the inverter. PU represents both a parameter unit and an operation panel (FR-DU07-CNV) in some sections of this manual.

* Batteries are not included in FR-PU07BB-L.

3.2.1 Parts identification of the parameter unit


POWER lamp
Lit when the power turns ON.
Monitor
● Liquid crystal display (16 characters × 4 lines with backlight)
● Interactive parameter setting
● Help function
● Trouble shooting guidance
● Monitor (current, power, etc.)
ALARM lamp
Lit to indicate an inverter alarm occurrence.
Operation keys
FR-PU07
POWER lamp
Lit when the power turns ON.
Battery exhaustion warning lamp
When a battery is low, the lamp color changes from green to orange.
Monitor
● Liquid crystal display (16 characters × 4 lines with backlight)
● Interactive parameter setting
● Help function
● Trouble shooting guidance
● Monitor (current, power, etc.)
ALARM lamp
Lit to indicate an inverter fault occurrence.
Operation keys
FR-PU07BB

3.2.2 Explanation of keys

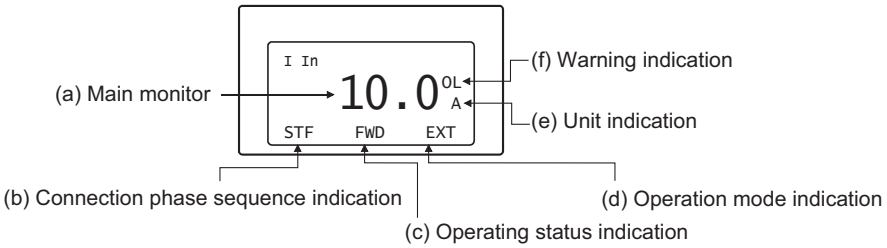
Key	Description
PrSET	Used to select the parameter setting mode. Press to select the parameter setting mode.
MON	Used to display the first priority screen. Used to display the input frequency when making an initial setting.
ESC	Operation cancel key.
FUNC	Used to display the function menu. A variety of functions can be used on the function menu.
SHIFT	Used to shift to the next item in the setting or monitoring mode.
0 to 9	Used to enter a parameter number or set value.
EXT	Cancels the PS (PS) display when the converter is stopped by the STOP RESET (PU stop).
PU	Does not function
▲ / ▼	• Press either of these keys on the parameter setting mode screen to change the parameter setting value sequentially. • On the selecting screen, these keys are used to move the cursor. • Hold down SHIFT and press either of these keys to advance or return the display screen one page.
FWD	Does not function
REV	Does not function
STOP RESET	• Stop command key. • Used to reset the converter when a fault occurs.
WRITE	• Used to write a set value in the setting mode. • Used as a clear key in the all parameter clear or fault history clear mode.
. READ	• Used as a decimal point when entering numerical value. • Used as a parameter number read key in the setting mode. • Used as an item select key on the menu screen such as parameter list or monitoring list. • Used as an fault definition display key in the fault history display mode. • Used as a command voltage read key in the calibration mode.

NOTE

- **Do not use a sharp-pointed tool to push the keys.**
- **Do not press your fingers against the liquid crystal display.**

3.2.3 Monitoring function

(1) Monitor display overview



a) Main monitor
Shows the input frequency, input current, bus voltage, fault history and other monitor data.

Press [READ] to display the monitoring list.

Select an item from the monitoring list and press [READ] to monitor the selected item.

The following items can be monitored.

I In .....: Input current[A]
V In .....: Input voltage[V]
Dc Bus .....: Bus voltage [V]
Alarm His .....: Fault history (The latest 8 faults are displayed)
Hz In .....: Power supply frequency[Hz]
THT %.....: Electronic thermal relay load factor[%]
Pwr In.....: Input power [kW]
Cum Pwr .....: Cumulative power [kW]
Cum Opr .....: Cumulative energization time[hr]
I/P Signal .....: Input signal
O/P Signal.....: Output signal

REMARKS

After the first and second priority monitors are changed by the *Pr. 52* setting or the terminals X1 and X2, the changed first and second monitors are displayed in the monitoring list at the reading of the monitoring list. If priority monitor is changed while the monitoring list is being read, the change of the priority monitor is not reflected.

b) Connection phase sequence indication
The following indicates the connection phase sequence.
STF .....: Positive phase
STR.....: Negative phase
--- .....: Power supply not detected

c) Operation status indication
The following indicates the operation status of the converter.
STOP ....: During the converter stop
FWD.....: During power drive
REV .....: During regenerative drive
ALAR ....: At fault occurrence

d) Operation mode indication
EXT is always indicated.

e) Unit indication
The unit of the main monitor is indicated.

f) Warning indication
The following is indicated when the converter outputs a warning.
Nothing is indicated when there is no warning.
For the details, *refer to page 124*.
OL .....: Overload signal detection
TH .....: Electronic thermal relay pre-alarm
PS .....: PU stop
MT.....: Maintenance signal output
SL .....: Power supply not detected
CP.....: Parameter copy

3.2.4 Function menu

Press (FUNC) in any operation mode to call the function menu, on which you can perform various functions.

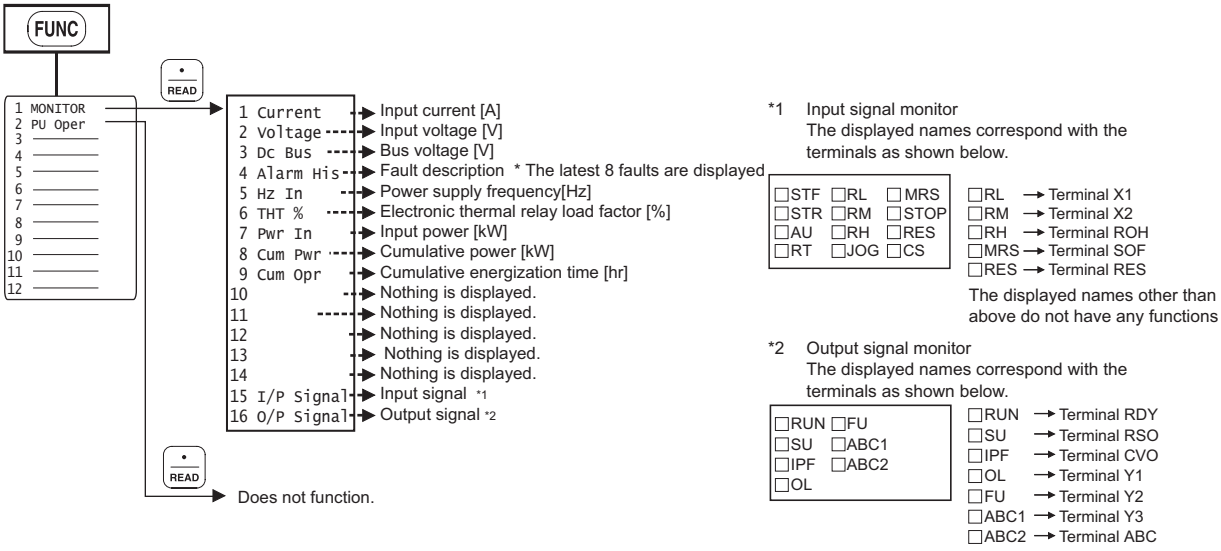
REMARKS

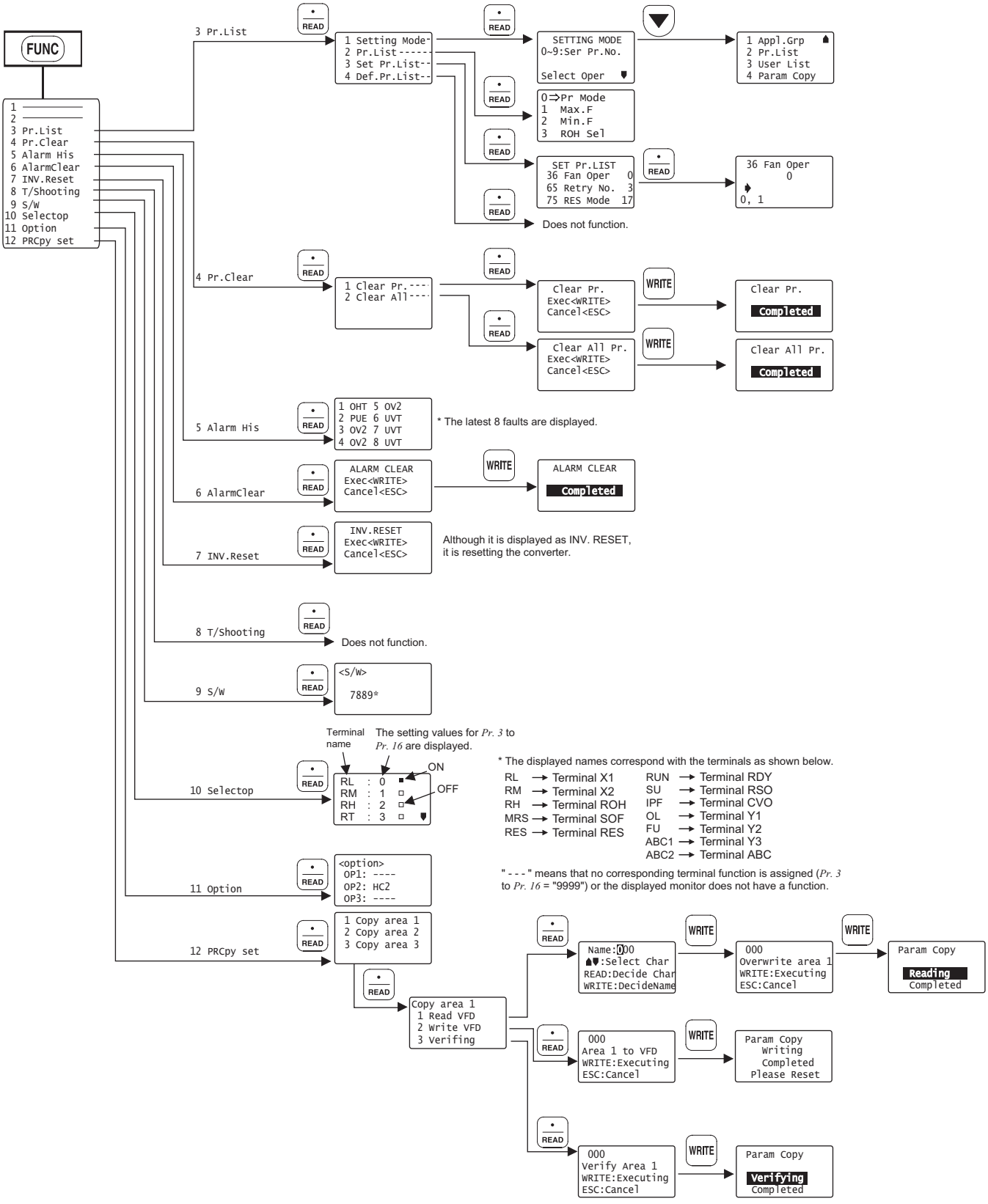
- Some menus are not available.

(1) Function menu list

Function menu	Description
1. MONITOR	The monitor list appears, and you can change from one monitor to another and set the first priority monitor.
2. PU Oper	This menu is displayed but its function is disabled.
3. Pr. List	The parameter menu appears, and you can perform "parameter setting" and "parameter change list display."
4. Pr. Clear	The parameter clear menu appears, and you can perform "parameter clear" and "all clear".
5. Alarm Hist	This function displays history of past eight faults (alarms).
6. AlarmClear	This function clears all the fault (alarm) history.
7. Inv.Reset	This function resets the converter. (Also resets the inverter at the same time.)
8. T/Shooting	This menu is displayed but its function is disabled.
9. S/W	This function displays the firmware control number of the converter.
10. Selectop	This menu is displayed but its function is disabled.
11. Option	This function displays the option fitting states of the option connectors 1 and 2.
12. FRCpy set	The function can perform the "parameter copy" (read, write, verification).

(2) Function menu transition




FUNC
1
2
3 Pr.List
4 Pr.Clear
5 Alarm His
6 AlarmClear
7 INV.Reset
8 T/Shooting
9 S/W
10 Selectop
11 Option
12 PRCpy set
READ
WRITE
3 Pr.List
1 Setting Mode
2 Pr.List
3 Set Pr.List
4 Def.Pr.List
SETTING MODE
0~9:Ser Pr.No.
Select Oper
1 Appl.Grp
2 Pr.List
3 User List
4 Param Copy
0⇒Pr Mode
1 Max.F
2 Min.F
3 ROH Sel
SET Pr.LIST
36 Fan Oper 0
65 Retry No. 3
75 RES Mode 17
36 Fan Oper
0
0, 1
Does not function.
4 Pr.Clear
1 Clear Pr.
2 Clear All
Clear Pr.
Exec<WRITE>
Cancel<ESC>
Completed
Clear All Pr.
Exec<WRITE>
Cancel<ESC>
Completed
5 Alarm His
1 OHT 5 OV2
2 PUE 6 UVT
3 OV2 7 UVT
4 OV2 8 UVT
* The latest 8 faults are displayed.
6 AlarmClear
ALARM CLEAR
Exec<WRITE>
Cancel<ESC>
ALARM CLEAR
Completed
7 INV.Reset
INV.RESET
Exec<WRITE>
Cancel<ESC>
Although it is displayed as INV. RESET, it is resetting the converter.
8 T/Shooting
Does not function.
9 S/W
<S/W>
7889*
10 Selectop
Terminal name
The setting values for Pr. 3 to Pr. 16 are displayed.
RL : 0
RM : 1
RH : 2
RT : 3
ON
OFF
* The displayed names correspond with the terminals as shown below.
RL → Terminal X1
RM → Terminal X2
RH → Terminal ROH
MRS → Terminal SOF
RES → Terminal RES
RUN → Terminal RDY
SU → Terminal RSO
IPF → Terminal CVO
OL → Terminal Y1
FU → Terminal Y2
ABC1 → Terminal Y3
ABC2 → Terminal ABC
"---" means that no corresponding terminal function is assigned (Pr. 3 to Pr. 16 = "9999") or the displayed monitor does not have a function.
11 Option
<option>
OP1: ----
OP2: HC2
OP3: ----
12 PRCpy set
1 Copy area 1
2 Copy area 2
3 Copy area 3
Copy area 1
1 Read VFD
2 Write VFD
3 Verifying
Name:000
:Select Char
READ:Decide Char
WRITE:DecideName
000
Overwrite area 1
WRITE:Executing
ESC:Cancel
Param Copy
Reading
Completed
000
Area 1 to VFD
WRITE:Executing
ESC:Cancel
Param Copy
Writing
Completed
Please Reset
000
Verify Area 1
WRITE:Executing
ESC:Cancel
Param Copy
Verifying
Completed

3.3 Parameter list

REMARKS

◎ indicates simple mode parameters.

The parameters shaded in allow their settings to be changed during operation even if "1" (write disabled) is set to *Pr. 77 Parameter write selection*.

Parameter	Name	Range	Increments	Initial value	Refer to page	Customer setting
◎ 0	Simple mode selection	0, 9999	1	0	71	
◎ 1	Maximum power supply frequency	60Hz (Read only)	—	60Hz	71	
◎ 2	Minimum power supply frequency	50Hz (Read only)	—	50Hz	71	
3	ROH terminal function selection	0 to 5, 9999	1	5	72	
4	SOF terminal function selection		1	0	72	
5	X1 terminal function selection		1	1	72	
6	X2 terminal function selection		1	2	72	
7	RES terminal function selection		1	3	72	
8	SOF input selection	0, 1, 2	1	0	73	
9	OH input selection	0, 1	1	0	73	
10	RDY signal logic selection	0, 100	1	100	74	
11	RSO terminal function selection	0 to 16, 98, 99, 100 to 116, 198, 199, 9999	1	1	74	
12	CVO terminal function selection		1	2	74	
◎ 13	Y1 terminal function selection		1	3	74	
◎ 14	Y2 terminal function selection		1	4	74	
◎ 15	Y3 terminal function selection		1	5	74	
16	ABC terminal function selection		1	99	74	
◎ 22	Current limit level	0 to 220%	0.1%	150%	75	
23	Current limit level (regenerative)	0 to 220%, 9999	0.1%	9999	75	
24	OL signal output timer	0 to 25s, 9999	0.1	0	75	
25	Input current detection level	0 to 220%	0.1%	150%	76	
26	Input current detection signal delay time	0 to 10s	0.1s	0s	76	
27	Input current detection signal retention time	0 to 10s, 9999	0.1s	0.1s	76	
28	Input current detection operation selection	0, 1	1	0	76	
29	Zero current detection level	0 to 220%	0.1%	5%	76	
30	Zero current detection time	0 to 1s	0.01s	0.5s	76	
31	Life alarm status display	0 to 15 (Read only)	1	0	77	
32	Inrush current limit circuit life display	0 to 100% (Read only)	1%	100%	77	
33	Control circuit capacitor life display	0 to 100% (Read only)	1%	100%	77	
34	Maintenance timer	0 (1 to 9998)	1	0	78	
35	Maintenance timer alarm output set time	0 to 9998, 9999	1	9999	78	
36	Cooling fan operation selection	0, 1	1	1	79	
44	Instantaneous power failure detection signal clear	0, 9999	1	9999	79	
45	AM output filter	0 to 5s	0.01s	0.01s	80	
46	Watt-hour meter clear	0, 10, 9999	1	9999	82	
47	Energization time carrying-over times	Read only	1	0	82	
48	Cumulative power monitor digit shifted times	0 to 4, 9999	1	9999	82	
49	Power supply frequency monitoring reference	45Hz to 65Hz	0.01Hz	60Hz	80	
◎ 50	AM terminal function selection	1 to 3, 5, 6, 7, 21, 1111 to 4444	1	1234	82	
◎ 51	Input power monitoring reference	0 to 100kW/0 to 3600kW*1	0.01kW/ 0.1kW*1	Rated power	80	
◎ 52	DU/PU main display data selection	0, 5 to 10, 25, 1111 to 4444	1	1234	82	
◎ 53	Input voltage monitoring reference	0 to 500V	0.1V	220V/ 440V*2	80	
◎ 54	FM terminal function selection	1 to 3, 5, 6, 7, 21, 1111 to 4444	1	1234	82	
◎ 55	Bus voltage monitoring reference	0 to 1000V	0.1V	340V/ 680V*2	80	

Parameter	Name	Range	Increments	Initial value	Refer to page	Customer setting
◎ 56	Current monitoring reference	0 to 500A/0 to 3600A*1	0.01A/ 0.1A*1	Rated current	80	
◎ 57	Restart selection	0, 9999	1	9999	85	
58	Free parameter 1	0 to 9999	1	9999	86	
59	Free parameter 2	0 to 9999	1	9999	86	
61	Key lock operation selection	0, 10	1	0	86	
◎ 65	Retry selection	0, 1, 2, 3, 4	1	0	87	
◎ 67	Number of retries at fault occurrence	0 to 10, 101 to 110	1	0	87	
◎ 68	Retry waiting time	0.1 to 360.0	0.1	1.0s	87	
◎ 69	Retry count display erase	0	1	0	87	
75	Reset selection/disconnected PU detection/ PU stop selection	0 to 3, 14 to 17	1	14	88	
◎ 77	Parameter write selection	1, 2	1	2	90	
80	Voltage control proportional gain	0 to 1000%	1%	100%	75	
81	Voltage control integral gain	0 to 1000%	1%	100%	75	
82	Current control proportional gain	0 to 200%	1%	100%	91	
83	Current control integral gain	0 to 200%	1%	100%	91	
117	PU communication station number	0 to 31	1	0	93	
118	PU communication speed	48, 96, 192, 384	1	192	93	
119	PU communication stop bit length	0, 1, 10, 11	1	1	93	
120	PU communication parity check	0, 1, 2	1	2	93	
121	Number of PU communication retries	0 to 10, 9999	1	1	93	
123	PU communication waiting time setting	0 to 150ms, 9999	1	9999	93	
124	PU communication CR/LF selection	0, 1, 2	1	1	93	
◎ 145	PU display language selection	0 to 7	1	0	114	
269	Parameter for manufacturer setting. Do not set.					
342	Communication EEPROM write selection	0, 1	1	0	113	
500 *3	Communication error execution waiting time	0 to 999.8s	0.1s	0	112	
501 *3	Communication error occurrence count display	0	1	0	112	
502 *3	Stop mode selection at communication error	0, 3	1	0	112	
542 *3,*4,*5	Communication station number (CC-Link)	1 to 64	1	1	105	
543 *3,*4,*5	Baud rate (CC-Link)	0 to 4	1	0	105	
544 *3,*4	CC-Link extended setting	0, 1, 12	1	0	105	
C0(900)*6	FM terminal calibration	—	—	—	115	
C1(901)*6	AM terminal calibration	—	—	—	115	
989	Parameter copy alarm release	10/100	1	10/100*2	118	
990	PU buzzer control	0, 1	1	1	114	
991	PU contrast adjustment	0 to 63	1	58	114	
Pr. CL	Parameter clear	0, 1	1	0	117	
ALLC	All parameter clear	0, 1	1	0	117	
Er.CL	Fault history clear	0, 1	1	0	132	
PCPY	Parameter copy	0, 1, 2, 3	1	0	118	

*1 Differ according to capacities. (55K or lower/75K or higher)
*2 Differs according to the voltage class. (200V class/400V class)
*3 Parameters which can be set when the plug-in option (FR-A7NC) is mounted.
*4 The setting is reflected after converter reset or at the next power-ON.
*5 "L.ERR" LED on FR-A7NC flickers when a setting is changed. If the converter is reset, the setting is reflected and LED turns off.
*6 The parameter number in parentheses is the one for use with the parameter unit (FR-PU07).

3.4 Description of parameters

3.4.1 Displaying and hiding extended parameters (Pr. 0)

Parameter which can be read from the operation panel and parameter unit can be restricted.

Parameter Number	Name	Initial Value	Setting Range	Description
0	Simple mode selection	0	9999	Only the simple mode parameters can be displayed.
			0	The simple mode and extended parameters can be displayed

- When *Pr. 0* ="9999", only the simple mode parameters can be displayed on the operation panel (FR-DU07-CNV) and parameter unit (FR-PU07). (For the simple mode parameters, refer to the parameter list on *page 69*).
- In the initial setting (*Pr. 0* ="0"), simple mode parameters and extended parameters can be displayed.

REMARKS

- When a plug-in option is connected to the converter, the option parameters can also be read.
- When reading the parameters using the communication option, all parameters can be read regardless of the *Pr. 0* setting.
- *Pr. 991 PU contrast adjustment* is displayed as simple mode parameter when the parameter unit (FR-PU07) is mounted.

3.4.2 Input frequency to converter (Pr. 1, Pr. 2)

The following parameters indicate that the converter is available for the use when the the power supply frequency is between 50Hz and 60Hz.

Parameter Number	Name	Initial Value	Setting Range	Description
1	Maximum power supply frequency	60Hz	60Hz	Indicates that the power supply frequency is 60Hz or lower, and the converter is available for the use. This parameter cannot be written.
2	Minimum power supply frequency	50Hz	50Hz	Indicates that the power supply frequency is 50Hz or higher, and the converter is available for the use. This parameter cannot be written.

3.4.3 Input terminal function selection (Pr. 3 to Pr. 7)

Use the following parameters to select/change the input terminal functions.

Parameter Number	Name	Initial Value	Initial Signal	Setting Range
3	**ROH terminal function selection**	5	ROH (ROH inrush resistance overheat detection)	0 to 5, 9999
4	**SOF terminal function selection**	0	SOF (converter stop)	
5	**X1 terminal function selection**	1	X1 (monitor switching)	
6	**X2 terminal function selection**	2	X2 (monitor switching)	
7	**RES terminal function selection**	3	RES (converter reset)	

(1) Input terminal function assignment

- Use *Pr. 3 to Pr. 7* to set the functions of the input terminals.
- Refer to the following table and set the parameters.

Setting	Signal Name	Function		Related Parameters	Refer to page
0	SOF	**Converter stop**	Turning ON this signal stops the converter. Operation can be changed using *Pr. 8*.	Pr. 8	—
1	X1	**Monitor switching**	Monitor item at PU (operation panel and parameter unit) and terminals FM and AM can be switched by a combination of ON/OFF of these signals.	Pr. 50, Pr. 52, Pr. 54	*82*
2	X2	**Monitor switching**			
3	RES	**Converter reset**	Turning ON this signal resets the converter.	—	—
4	OH	**External thermal relay input**	The signal is input from the external thermal relay. Turning ON the signal stops the converter operation. (E.OHT) Operation can be changed using *Pr. 9*.	Pr. 9	—
5	ROH	**ROH inrush resistance overheat detection**	The ROH signal turns OFF and the converter trips (E.IOH) when overheating from the inrush resistance occurs or the filter capacitor (FR-HCC2) is detected to be swollen *. * Filter capacitor alarm detector is only available for 560K.	—	—
9999	—	**No function**		—	—

REMARKS

- The signals other than the ROH signal can be assigned to two or more terminals. In this case, the logic of terminal input is OR. If the ROH signal, which is assigned to several terminals, turns OFF once, the converter remains tripped until the ROH signal turns ON at all the terminals.

NOTE

- **Changing the terminal assignment using *Pr. 3 to Pr. 7* (input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.**

3.4.4 Operation selection of SOF signal and OH signal (Pr. 8, Pr. 9)

Operation of SOF signal can be changed by the *Pr. 8* setting, and OH signal by the *Pr. 9* setting.

Parameter Number	Name	Initial Value	Setting Range	Description
8	SOF input selection	0	0	Turning the SOF signal ON stops the converter operation. (NO contact)
			1	Turning the SOF signal OFF stops the converter operation. (NC contact)
			2	External signal: NC contact CC-Link communication: NO contact
9	OH input selection	0	0	Turning the OH signal ON trips the converter. (NO contact)
			1	Turning the OH signal OFF trips the converter. (NC contact)

<SOF signal input status and *Pr. 8* setting for the converter operation >

SOF Signal Input Status		Converter Operation		
External terminal	Virtual terminal for CC-Link communication	*Pr.8* = 0 (NO contact)	*Pr.8* = 1 (NC contact) *	*Pr.8* = 2 (External terminal: NC contact) (Virtual terminal at CC-Link communication: NO contact)
OFF	OFF	Operation continues	Operation stops	Operation stops
OFF	ON	Operation stops	Operation stops	Operation stops
ON	OFF	Operation stops	Operation stops	Operation continues
ON	ON	Operation stops	Operation continues	Operation stops

* The converter does not operate at the *Pr. 8* = "1" (NC contact) setting while FR-A7NC is not mounted. Set *Pr. 8* = "2" (NC contact for external signals, NO contact for CC-Link communication).

<OH signal input status and Pr.9 setting for the converter operation >

OH Signal Input Status (external terminal)	Converter Operation	
	Pr.9 = 0	*Pr.9* = 1
ON	Trips	Operation continues
OFF	Operation continues	Trips

3.4.5 Output terminal function selection (Pr. 10 to Pr. 16)

Use the following parameters to change the functions of the open collector output terminals and relay output terminal.

Parameter Number	Name		Initial Value	Initial Signal	Setting Range
10	RDY signal logic selection	Open collector output terminal	100	RDY (Inverter run enable signal)	0, 100
11	RSO terminal function selection		1	RSO (converter reset)	0 to 16, 98, 99, 100 to 116, 198, 199, 9999
12	CVO terminal function selection		2	CVO (converter running)	
13	Y1 terminal function selection		3	OL (overload alarm)	
14	Y2 terminal function selection		4	PHS (power supply phase detection)	
15	Y3 terminal function selection		5	Y5 (output voltage match)	
16	ABC terminal function selection	Relay output terminal	99	ALM (fault output)	

(1) Output signal list

- Functions of the output terminals can be set.
- Refer to the following table and set the parameters. (0 to 99: Positive logic, 100 to 199: Negative logic)

Setting		Signal Name	Function	Operation	Related Parameters	Refer to page
Positive Logic	Negative Logic					
0	100	RDY	Inverter run enable signal	Output when inverter can run.	—	—
1	101	RSO	Converter reset	Output during a converter reset.	—	—
2	102	CVO	During converter run	Output when the converter is running.	—	—
3	103	OL	Overload alarm	Output when the current limit function is active.	Pr. 22, Pr. 23, Pr. 24	*75*
4	104	PHS	Power supply phase detection	Output when a phase is confirmed after a completion of the power supply phase detection.	—	—
5	105	Y5	Output voltage match	Output when the detected bus voltage equals to the commanded bus voltage.	—	—
6	106	IPF	Instantaneous power failure	Output when an instantaneous power failure is detected.	Pr. 57	*85*
7	107	Y7	Regenerative drive recognition	Output at regenerative operation.	—	—
8	108	THP	Electronic thermal relay pre-alarm	Output when the electronic thermal relay cumulative value reaches 85% of the transistor protection thermal activation level. (Electronic thermal relay protection (E.THT) activates when the value reaches 100%.)	—	—
9	109	FAN	Fan fault output	Output at the time of a fan fault.	Pr. 36	*79*
10	110	FIN	Heatsink overheat pre-alarm	Output when the heatsink temperature reaches about 85% of the heatsink overheat protection providing temperature.	—	—
11	111	RTY	During retry	Output during retry processing.	Pr. 65, Pr. 67 to Pr. 69	*87*
12	112	Y12	Input current detection	Output when the converter's input current is higher than the *Pr. 25* setting for longer than the time set in *Pr. 26*.	Pr. 25, Pr. 26	*76*
13	113	Y13	Zero current detection	Output when the converter's input current is lower than the *Pr. 29* setting for longer than the time set in *Pr. 30*.	Pr. 29, Pr. 30	*76*
14	114	Y14	Life alarm	Output when the control circuit capacitor or the inrush current limit circuit approaches the end of its service life.	Pr. 31 to Pr. 33	*77*
15	115	Y15	Maintenance timer signal	Output when *Pr. 34* rises to or above the *Pr. 35* setting.	Pr. 34, Pr. 35	*78*
16	116	Y16	Instantaneous power failure detection hold	This signal is output when the IPF signal turns ON. Output of this signal is held until a reset or *Pr. 44* = "0" is set. This signal is available during the high power factor converter operation.	Pr. 44	*79*
98	198	LF	Alarm output	Output when an alarm (fan failure or communication error warning) occurs.	Pr. 36, Pr. 121	*79, 94*
99	199	ALM	Fault output	Output when the converter's protective function activates to stop the output (at fault occurrence).	—	—
9999		—	No function	—	—	—

3.4.6 DC voltage control (Pr. 22 to Pr. 24, Pr. 80, Pr. 81)

DC voltage of the converter can be controlled to be as commanded.
Operation should be stable in the initial setting, but adjust the following parameters when voltage fluctuation occurs due to the environment such as a voltage condition.

Parameter Number	Name	Initial Value	Setting Range	Description
22	**Current limit level**	150%	0 to 220%	Set the current level where the current limit operation starts (during power driving).
23	**Current limit level (regenerative)**	9999	0 to 220%	Set the current level where the current limit operation starts (during regenerative driving).
			9999	Same as *Pr. 22*
24	**OL signal output timer**	0	0 to 25s, 9999	Set the OL signal output start time at the activation of current limit operation.
80	**Voltage control proportional gain**	100%	0 to 1000%	Set the proportional gain for the voltage control. Increasing the setting value reduces the DC voltage fluctuation caused by external disturbance.
81	**Voltage control integral gain**	100%	0 to 1000%	Set the integral gain for the voltage control. Increasing the setting value shortens the recovery time from the DC voltage fluctuation caused by external disturbance.

(1) Adjustment for the DC voltage fluctuation *(Pr. 80, Pr. 81)*

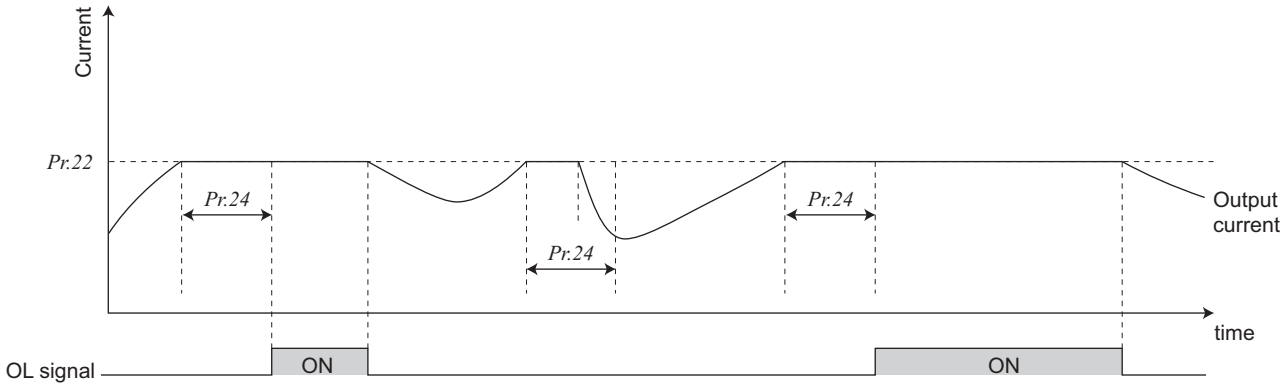
- Adjust the fluctuation range of the DC voltage by setting *Pr. 80*.
  Increasing the setting value reduces the DC voltage fluctuation caused by external disturbance.
- Adjust the recovery time to the commanded value at a fluctuation of DC voltage by setting *Pr. 81*.
  Increasing the setting value shortens the recovery time from the DC voltage fluctuation caused by external disturbance.

NOTE

- **Setting *Pr. 80* too large makes the operation unstable.**
- **Setting only *Pr. 81* too large makes the operation unstable.**

(2) Setting the current limit level *(Pr. 22 to Pr. 24)*

- This function limits the output current of the converter at a specified value.
  Set the current limit level to *Pr. 22*. Current limit level at the regenerative operation can be individually set by setting a value other than "9999" to *Pr. 23*
  For *Pr. 22 and Pr. 23*, set current limits in ratios against the converter rated current.
- OL signal is output when an output current is limited by the current limit level (when the current limit function is active).
  For *Pr. 24*, set a time from when the command current reaches the current limit level until OL signal is output.



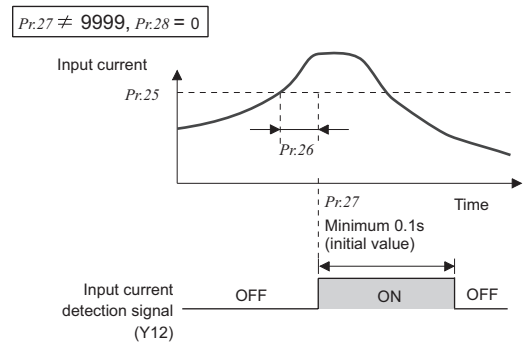
NOTE

- **When the output current reaches the current limit level, DC voltage decreases during power driving, and DC voltage increases during regeneration.**

3.4.7 Input current detection function (Y12 signal, Y13 signal, Pr. 25 to Pr. 30)

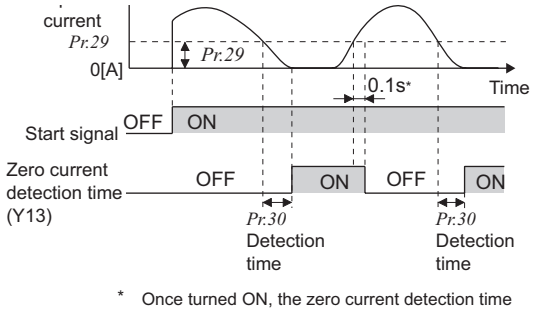
The input current during converter running can be detected and output to the output terminal.

Parameter Number	Name	Initial Value	Setting Range	Description
25	**Input current detection level**	150%	0 to 220%	Set the input current detection level. 100% is the rated converter current.
26	**Input current detection signal delay time**	0s	0 to 10s	Set the input current detection period. Set the time from when the input current has risen above the setting until the input current detection signal (Y12) is output.
27	**Input current detection signal retention time**	0.1s	0 to 10s	Set the retention time when Y12 signal is ON.
			9999	Y12 signal ON status is retained. The signal is turned OFF at the next start.
28	**Input current detection operation selection**	0	0	Operation continues when Y12 signal is ON.
			1	Converter trips when Y12 signal is ON. (E.CDO)
29	**Zero current detection level**	5%	0 to 220%	Set the zero current detection level. The rated converter current is regarded as 100%.
30	**Zero current detection time**	0.5s	0 to 1s	Set the period from when the input current drops below the *Pr. 29* value until the zero current detection signal (Y13) is output.



(1) Input current detection (Y12 signal, *Pr. 25 to Pr. 28*)

- If the input current remains higher than the *Pr. 25* setting during the converter operation for longer than the time set in *Pr. 26*, the output current detection signal (Y12) is output from the converter's open collector or relay output terminal.
- When Y12 signal turns ON, the ON state is held for the time set in *Pr. 27*.
- When *Pr. 27* = "9999", the ON state is held until the next start.
- When *Pr. 28* = "1", turning Y12 signal ON stops the output of the converter and displays the input current detection alarm (E.CDO). When the trip occurs, Y12 signal stays ON for the time set in *Pr. 27* with *Pr. 27* ≠ 9999 setting, and Y12 signal stays ON until a reset with *Pr. 27* = 9999 setting. E.CDO does not occur by setting *Pr. 28* = "1" while Y12 is ON. *Pr. 28* setting becomes valid after Y12 signal turns OFF.
- Set "12 (positive logic)" or "112 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)* to assign the function of Y12 signal to the output terminal.



* Once turned ON, the zero current detection time signal (Y13) is held on for at least 0.1s.

(2) Zero current detection (Y13 signal, *Pr. 29, Pr. 30*)

- If the input current remains lower than the *Pr. 29* setting during the converter operation for longer than the time set in *Pr. 30,* the zero current detection signal (Y13) is output from the converter's open collector or relay output terminal.
- Set "13 (positive logic)" or "113 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)* to assign the function of Y13 signal to the output terminal.

NOTE

- **The response time of Y12 and Y13 signals is approximately 0.1s. Note that the response time varies with the load.**
- **Changing the terminal assignment using *Pr. 11 to Pr. 16 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.**

⚠ CAUTION

⚠ A safety backup such as an emergency brake must be provided to prevent hazardous condition to the machine and equipment when using the zero current detection signal.

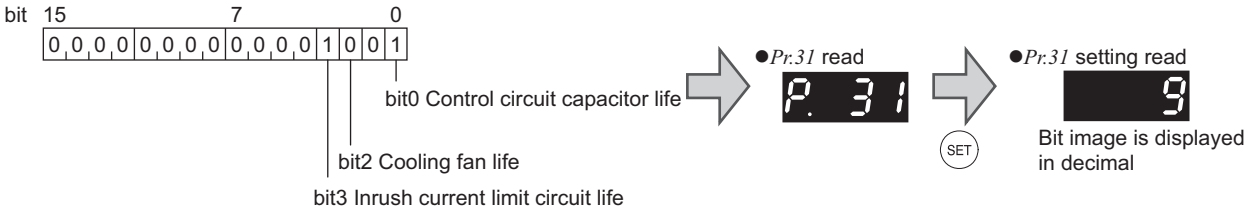
3.4.8 Displaying the life of the converter parts (Pr. 31 to Pr. 33)

Degrees of deterioration of control circuit capacitor, cooling fan and inrush current limit circuit can be diagnosed by the monitor.
When any part has approached the end of its life, an alarm can be output by self diagnosis to prevent a fault.
(Use the life check of this function as a guideline since the life is calculated theoretically.)

Parameter Number	Name	Initial Value	Setting Range	Description
31	**Life alarm status display**	0	(0 to 15)	Displays whether the control circuit capacitor, cooling fan, and each parts of the inrush current limit circuit has reached the life alarm output level or not. Reading only
32	**Inrush current limit circuit life display**	100%	(0 to 100%)	Displays the deterioration degree of the inrush current limit circuit. Reading only
33	**Control circuit capacitor life display**	100%	(0 to 100%)	Displays the deterioration degree of the control circuit capacitor. Reading only

(1) Life alarm display and signal output (Y14 signal, *Pr. 31*)

• Whether any of the control circuit capacitor, cooling fan, and inrush current limit circuit has reached the life alarm output level or not can be checked by *Pr. 31 Life alarm status display* and life alarm signal (Y14).


bit 15 7 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1
bit0 Control circuit capacitor life
bit2 Cooling fan life
bit3 Inrush current limit circuit life
●Pr.31 read
P. 31
SET
●Pr.31 setting read
9
Bit image is displayed in decimal

Pr. 255 (decimal)	bit (binary)	Inrush Current Limit Circuit Life	Cooling Fan Life	Control Circuit Capacitor Life
13	1101	○	○	○
12	1100	○	○	×
9	1001	○	×	○
8	1000	○	×	×
5	0101	×	○	○
4	0100	×	○	×
1	0001	×	×	○
0	0000	×	×	×

○:With warnings, ×: Without warnings

• The life alarm signal (Y14) turns ON when any of the control circuit capacitor, cooling fan and inrush current limit circuit reaches the life alarm output level.
• For the terminal used for the Y14 signal, set "14 (positive logic)" or "114 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*.

NOTE

• Changing the terminal assignment using *Pr. 11 to Pr. 16 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.

(2) Life display of the inrush current limit circuit *(Pr. 32)*

- The life of the inrush current limit circuit (relay, contactor and inrush resistor) is displayed in *Pr. 32*.
- The number of contact (relay, contactor, thyristor) ON times is counted, and it is counted down from 100% (0 time) every 1%/1,000 times.
  As soon as 10% (90,000 times) is reached, *Pr. 31* bit 3 is turned ON, and also an alarm is output to Y14 signal.

(3) Control circuit capacitor life display *(Pr. 33)*

- The deterioration degree of the control circuit capacitor is displayed in *Pr. 33* as a life.
- In the operating status, the control circuit capacitor life is calculated from the energization time and temperature, and is counted down from 100%.
  As soon as the control circuit capacitor life falls below 10%, *Pr. 31* bit 0 is turned ON, and also an alarm is output to Y14 signal.

(4) Cooling fan life display

- The cooling fan speed of 50% or less is detected and "FN" is displayed on the operation panel (FR-DU07-CNV) and parameter unit (FR-PU07). As an alarm display, *Pr. 31* bit 2 is turned ON, and also an alarm is output to the Y14 signal.

REMARKS

- When the converter is mounted with two or more cooling fans, "FN" is displayed with one or more fans with speed of 50% or less.

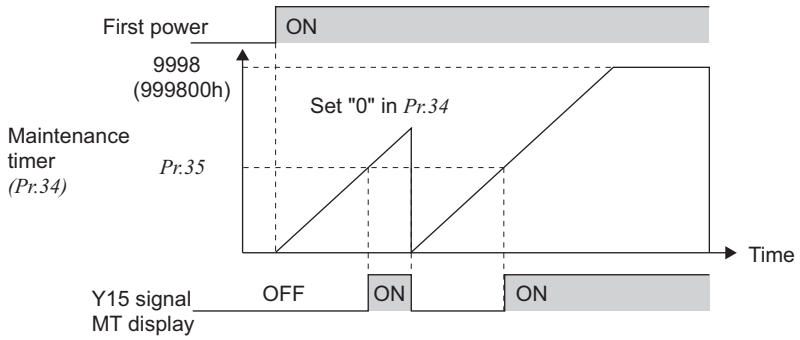
NOTE

- **For replacement of each part, contact the nearest Mitsubishi FA center.**

3.4.9 Maintenance timer alarm (Pr. 34, Pr. 35)

When the cumulative energization time of the converter reaches the parameter set time, the maintenance timer output signal (Y15) is output. MT (MT) is displayed on the operation panel (FR-DU07-CNV).
This can be used as a guideline for the maintenance time of peripheral devices.

Parameter Number	Name	Initial Value	Setting Range	Description
34	**Maintenance timer**	0	0(1 to 9998)	Displays the cumulative energization time of the converter in 100h increments. Reading only Writing the setting of "0" clears the cumulative energization time.
35	**Maintenance timer alarm output set time**	9999	0 to 9998	Set the time taken until when the maintenance timer alarm output signal (Y15) is output.
			9999	No function



- The cumulative energization time of the converter is stored into the EEPROM every hour and indicated in *Pr. 34 Maintenance timer* in 100h increments. *Pr. 34* is clamped at 9998 (999800h).
- The maintenance timer alarm output signal (Y15) is output when the time set in *Pr. 34* has reached the time set in *Pr. 35 Maintenance timer alarm output set time* (100h increments).
- For the terminal used for Y15 signal, set "15 (positive logic)" or "115 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*.

NOTE

- **The cumulative energization time is counted every hour. The energization time of less than 1h is not counted.**
- **Changing the terminal assignment using *Pr. 11 to Pr. 16 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.**

3.4.10 Cooling fan operation selection (Pr. 36)

Cooling fans built into the converter can be controlled.

Parameter Number	Name	Initial Value	Setting Range	Description
36	Cooling fan operation selection	1	0	A cooling fan operates at power ON. Cooling fan ON/OFF control is invalid. (The cooling fan is always ON at power ON)
			1	Cooling fan ON/OFF control is valid. The fan is always ON while the converter is running. During a stop, the converter status is monitored and the fan switches ON/OFF according to the temperature.

- In either of the following cases, fan operation is regarded as faulty, and [FN] is displayed on the operation panel, and the fan fault (FAN) and minor fault (LF) signals are output.
  - *Pr. 36* = "0"
    When the fan comes to a stop with power ON.
  - *Pr. 36* = "1"
    When the fan stops during the fan ON command while the converter is running

- For the terminal used for the FAN signal output, set "9 (positive logic)" or "109 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*, and for LF signal, set "98 (positive logic)" or "198 (negative logic)".

NOTE

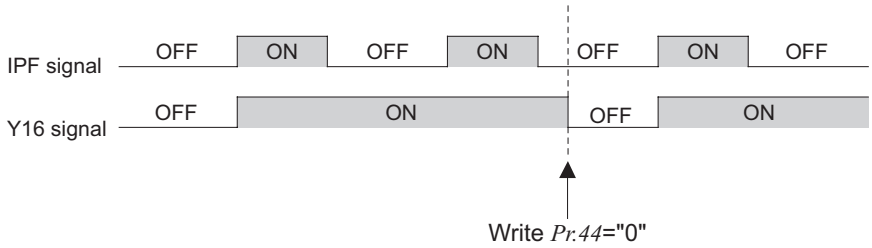
- **Changing the terminal assignment using *Pr. 11 to Pr. 16 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.**

3.4.11 Instantaneous power failure detection hold (Pr.44)

Use this function to check the history of instantaneous power failures.

Parameter Number	Name	Initial Value	Setting Range	Description
44	Instantaneous power failure detection signal clear	9999	0	Turns OFF the instantaneous power failure detection hold signal (Y16).
			9999	Does not turn OFF the instantaneous power failure detection hold signal (Y16)

- Instantaneous power failure detection hold signal (Y16) turns ON when the instantaneous power failure signal (IPF) turns ON during the high power factor converter operation. The Y16 signal is turned OFF by a reset or by setting *Pr.44* = "0."
- For the terminal used for the Y16 signal, set "16 (positive logic)" or "116 (negative logic)" to any of *Pr. 11 to Pr. 16* (*output terminal function selection*).



NOTE

- ***Pr. 44* is always read as "9999." The Y16 signal does not turn OFF even if *Pr. 44* = "9999."**
- **Changing the terminal assignment using *Pr.11 to Pr.16 (Output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.**

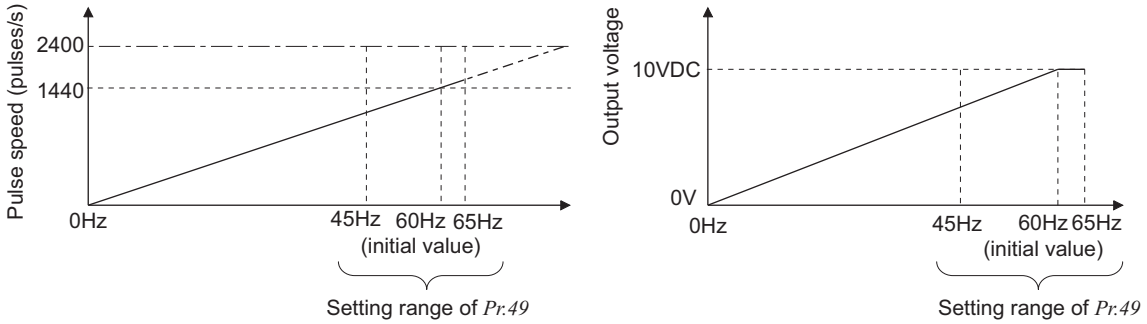
3.4.12 Reference of the terminal FM (pulse train output) and terminal AM (analog output) (Pr. 45, Pr. 49, Pr. 51, Pr. 53, Pr. 55, Pr. 56)

Two types of monitor output, pulse train output from the terminal FM and analog voltage output from the terminal AM, are available.
Set the reference of the signal output from the terminals FM and AM.

Parameter Number	Name	Initial value		Setting range		Description
45	AM output filter	0.01s		0 to 5s		Set the output filter of terminal AM.
49	Power supply frequency monitoring reference	60Hz		45Hz to 65Hz		Set the full-scale value when outputting the power supply frequency monitor value from terminal FM or AM.
51	Input power monitoring reference	Rated converter power		55K or lower	0 to 100kW	Set the full-scale value when outputting the input power monitor value from terminal FM or AM.
				75K or higher	0 to 3600kW	
53	Input voltage monitoring reference	200V class	220V	0 to 500V		Set the full-scale value when outputting the input voltage monitor value from terminal FM or AM.
		400V class	440V			
55	Bus voltage monitoring reference	200V class	340V	0 to 1000V		Set the full-scale value when outputting the bus voltage monitor value from terminal FM or AM.
		400V class	680V			
56	Current monitoring reference	Rated converter current		55K or lower	0 to 500A	Set the full-scale value when outputting the input current monitor value from terminal FM or AM.
				75K or higher	0 to 3600A	

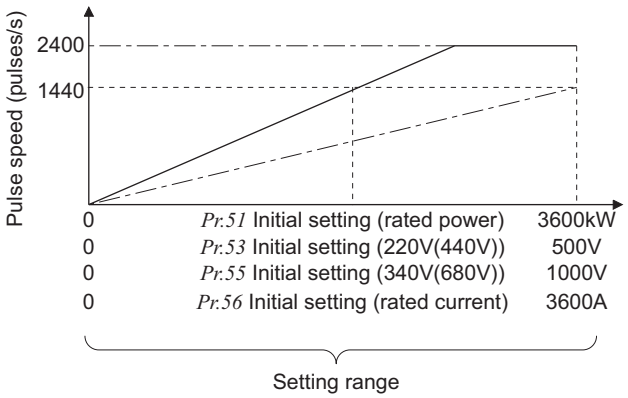
(1) Reference for power supply frequency monitor*(Pr. 49)*

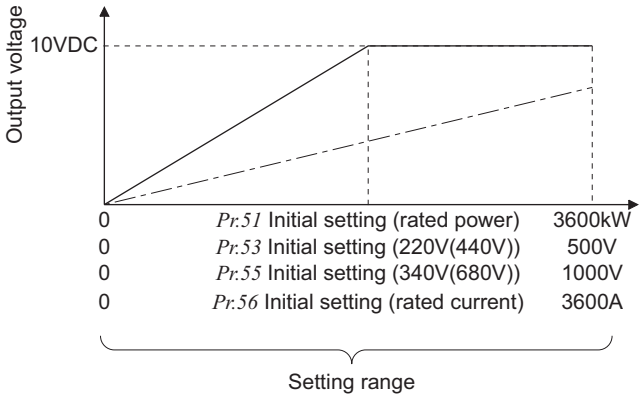
- For the calibration of terminal FM, set the full-scale value of the connected meter when the pulse speed of the terminal FM is 1440 pulses/s.
  Set the frequency to be indicated as the full-scale value on the frequency meter (1mA analog meter) connected between terminal FM and SD.
  The pulse speed is proportional to the power supply frequency. (The maximum pulse train output is 2400 pulses/s.)
- For the calibration of terminal AM, set the full-scale value of the connected meter when output voltage of terminal AM is 10VDC.
  Set the frequency to be indicated as the full-scale value on the meter (10VDC voltmeter) connected between terminal AM and 5.
  Output voltage is proportional to the frequency. (Maximum output voltage is 10VDC.)



(2) Reference for input power monitor *(Pr. 51)*, input voltage monitor *(Pr. 53)*, bus voltage monitor *(Pr. 55)*, and current monitor *(Pr. 56)*.

- For the calibration of terminal FM, set the full-scale value of the connected meter when the pulse speed of terminal FM is 1440 pulse/s.
  Set the power (kW), voltage (V) and current (A) to be indicated as the full-scale values to the frequency meter (1mA analog meter) connected between terminal FM and SD.
  Pulse speed is proportional to each monitor. (Maximum pulse train output is 2400 pulse/s.)
- For the calibration of terminal AM, set the full-scale value of the connected meter when output voltage of terminal AM is 10VDC.
  Set the power (kW), voltage (V) and current (A) to be indicated as the full scale values on the meter (10VDC voltmeter) connected between terminal AM and 5.
  Output voltage is proportional to each monitor. (Maximum output voltage is 10VDC.)





(3) Terminal AM response adjustment *(Pr. 45)*

- Using *Pr. 45*, the output voltage response of the terminal AM can be adjusted in the range of 0 to 5s.
- Increasing the setting stabilizes the terminal AM output more but reduces the response level. (Setting "0" sets the response level to 7ms.)

3.4.13 DU/PU, terminal FM/AM monitor display selection (Pr. 46 to Pr. 48, Pr. 50, Pr. 52, Pr.54)

The monitor to be displayed on the main screen of the operation panel (FR-DU07-CNV)/parameter unit (FR-PU07) can be selected.
In addition, signals to be output from the terminal FM (pulse train output) and AM (analog voltage output) can be selected.

Parameter Number	Name	Initial value	Setting range	Description
46	Watt-hour meter clear	9999	0	Set "0" to clear the watt-hour meter monitor.
			10	Set the maximum value in the range of 0 to 9999kWh for the monitoring from communication
			9999	Set the maximum value in the range of 0 to 65535kW for the monitoring from communication.
47	Energization time carrying-over times	0	0 to 65535 (Reading only)	Displays the numbers of times that the cumulative energization time monitor exceeded 65535h. Reading only
48	Cumulative power monitor digit shifted times	9999	0 to 4	Set the number of times to shift the cumulative power monitor digit. The monitor value is clamped at the maximum value.
			9999	No shift The monitor value is cleared when it exceeds the maximum value.
50	AM terminal function selection	1234	1 to 3, 5, 6, 7, 21, 1111 to 4444	Select the monitor output to terminal AM.
52	DU/PU main display data selection	1234	0, 5 to 10, 25, 1111 to 4444	Select the monitor to be displayed on the operation panel and parameter unit. Refer to the following table for monitor description.
54	FM terminal function selection	1234	1 to 3, 5, 6, 7, 21, 1111 to 4444	Select the monitor output to terminal FM.

(1) Monitor description list *(Pr. 52)*

- Set the monitor to be displayed on the operation panel (FR-DU07-CNV) and parameter unit (FR-PU07) in *Pr. 52 DU/PU main display data selection*.
- Set the monitor to be output to the terminal FM (pulse train output) in *Pr. 54 FM terminal function selection*
- Set the monitor to be output to the terminal AM (0 to 10VDC analog voltage output) in *Pr. 50 AM terminal function selection*
- Refer to the following table and set the monitor to be displayed. (The signals marked × cannot be selected for monitoring)

Types of Monitor	Increments	*Pr. 52* Setting		*Pr. 54* (FM) *Pr. 50* (AM) Setting	Full-scale Value of the Terminal FM and AM	Description
		DU LED	PU main monitor			
Input current	0.01A/0.1A*4	0		1	*Pr. 56*	Displays the converter input current.
Input voltage	0.1V	0		2	*Pr. 53*	Displays the converter input voltage effective value.
Bus voltage	0.1V	0		3	*Pr. 55*	Displays the converter output voltage.
Fault display	—	0		×	——	Displays 8 past faults individually.
Power supply frequency	0.01Hz	5		5	*Pr. 49*	Displays power supply frequency.
Electronic thermal relay load factor	0.1%	6		6	100%	Displays the motor thermal cumulative value by regarding the thermal operation level as 100%.
Input power	0.01kW/ 0.1kW*4	7		7	*Pr. 51*	Displays the converter input power.
Cumulative power *3	0.01kWh/ 0.1kWh *2*4	8		×	—	Displays the cumulative power based on the input power monitor. Can be cleared by *Pr. 46 (Refer to page 83)*
Cumulative energization time *1	1h	9		×	—	Displays the cumulative energization time since the converter shipment. You can check how many times the monitor value exceeded 65535h with *Pr. 47*.
Input power (with regenerative display)	0.1kW/1kW *5	10		×	—	Displays the converter input power The value is displayed with "-" (minus sign) during the regenerative driving.
Reference voltage output	—	——		21	—	Terminal FM: 1440 pulse/s is output. Terminal AM: 10V is output.
Input terminal status	—	25	×	×	—	Displays the input terminal ON/OFF status on the operation panel *(Refer to page 83)*
Output terminal status	—		×	×	—	

Types of Monitor	Increments	*Pr. 52* Setting		*Pr. 54* (FM) *Pr. 50* (AM) Setting	Full-scale Value of the Terminal FM and AM	Description
		DU LED	PU main monitor			
Switching by input terminal	Depends on the monitor	1111 to 4444			Depends on the monitor	Monitoring item is changed by ON/OFF of input terminal.*(Refer to page 85)*

∗1 The cumulative energization time is accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.
When the operation panel (FR-DU07-CNV) is used, the time is displayed up to 65.53 (65530h) by regarding 1h = 0.001, and thereafter, it is added up from 0.
∗2 When using the parameter unit (FR-PU07), "kW" is displayed
∗3 Since the panel display of the operation panel (FR-DU07-CNV) is in four digits, the monitor value of more than "9999" is displayed as "----".
∗4 Differ according to capacities. (55K or lower/75K or higher)
∗5 It is displayed only in FR-DU07-CNV.

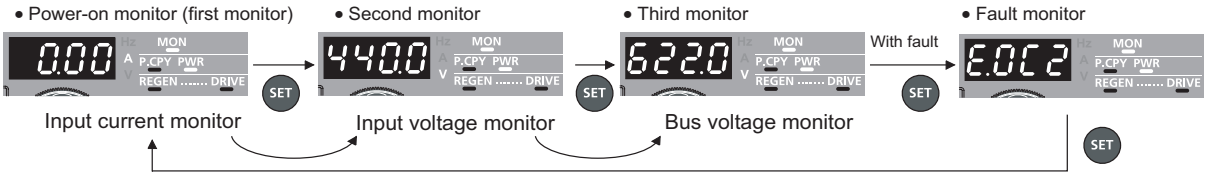
REMARKS

- By setting "0" to *Pr. 52*, the monitoring of output frequency to alarm display can be selected in sequence by SET.
- When the operation panel (FR-DU07-CNV) is used, the displayed units are Hz, V and A only and the others are not displayed.
- The monitor set in *Pr. 52* is displayed in the second monitor position. (The input voltage monitor is changed.) Note that the input terminal status and the output terminal status are displayed in the third monitor (bus voltage) position.

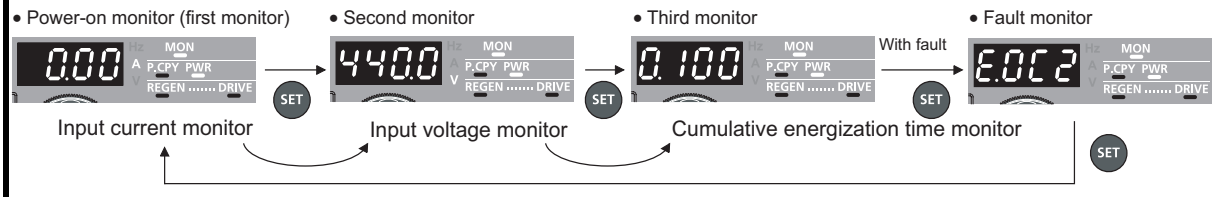
Initial setting

* The monitor displayed at powering ON is the first monitor. Display the monitor you want to display on the first monitor and hold down SET for 1s.

(To return to the input current monitor, display the input current monitor and hold down SET for 1s.)

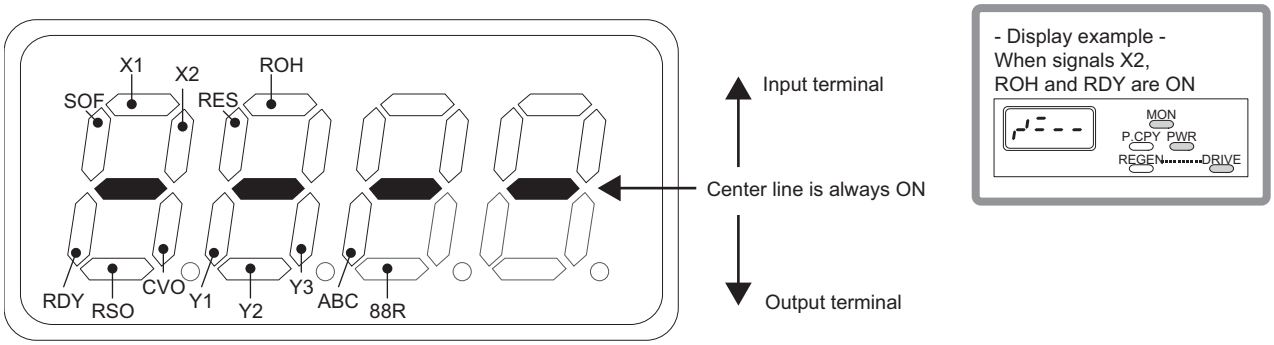


Example) When *Pr. 52* = "9" (cumulative energization time), the monitor is displayed on the operation panel as shown below.



(2) Operation panel (FR-DU07-CNV) I/O terminal monitor *(Pr. 52)*

- When *Pr. 52* = "25", the I/O terminal states can be monitored on the operation panel (FR-DU07-CNV).
- The I/O terminal monitor is displayed on the third monitor.
- The LED is ON when the terminal is ON, and the LED is OFF when the terminal is OFF. The center line of LED is always ON.
- On the I/O terminal monitor, the upper LEDs indicate the input terminal status, and the lower LEDs indicate the output terminal status.



(3) Cumulative power monitor and clear *(Pr. 46, Pr. 48)*

- On the cumulative power monitor *(Pr. 52 = "8")*, the output power monitor value is added up and is updated in 1h increments.
- Display increments and display ranges of the operation panel (FR-DU07-CNV), parameter unit (FR-PU07) and communication (RS-485 communication) are as indicated below.

Operation Panel*1		Parameter Unit*2		Communication		
Range	Increments	Range	Increments	Range		Increments
				Pr. 46 = 10	*Pr. 46* = 9999	
0 to 99.99kWh	0.01kWh	0 to 999.99kWh	0.01kWh	0 to 9999kWh	0 to 65535kWh (Initial setting)	1kWh
100.0 to 999.9kWh	0.1kWh	1000.0 to 9999.9kWh	0.1kWh			
1000 to 9999kWh	1kWh	10000 to 99999kWh	1kWh			

*1 Power is measured in the range of 0 to 9999.99kWh, and displayed in four digits.
When the monitor value exceeds "99.99", a carry occurs, e.g. "100.0", so the value is displayed in 0.1kWh increments.

*2 Power is measured in the range of 0 to 99999.99kWh, and displayed in five digits.
When the monitor value exceeds "999.99", a carry occurs, e.g. "1000.0", so the value is displayed in 0.1kWh increments.

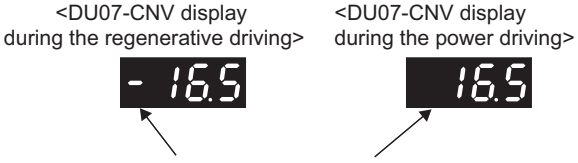
- The monitor data digit can be shifted to the right by the number of *Pr. 48*.
  For example, if the cumulative power value is 1278.56kWh when *Pr. 48* = "2", the PU/DU display is 12.78 (display in 100kWh increments) and the communication data is 12.
- If the maximum value is exceeded at *Pr. 48* = "0 to 4", the power is clamped at the maximum value, indicating that a digit shift is necessary. If the maximum value is exceeded at *Pr. 48* = "9999", the power returns to 0, and the counting starts again.
- Writing "0" in *Pr. 46* clears the cumulative power monitor.

REMARKS

- If "0" is written to *Pr. 46*, and *Pr. 46* is read again, "9999" or "10" is displayed.

(4) Input power (with regenerative display) (*Pr. 52* = "10")

- On the input power monitor (with regenerative display) (*Pr.52* = "10"), the input power to the converter is displayed with a sign.
- On the operation panel (FR-DU07-CNV), the input power is displayed as a positive value (no sign) during the power driving and displayed with a minus sign during the regenerative driving.



The first 7-segment LED is only used to display the sign.

- When the monitored value is 100kW or more, the displayed unit is 1kW. When the power value is 1000kW or more, it is limited at 999kW. When the power value is -1000kW or less, it is limited at -999kW.
- Positive value (no sign) is displayed in the input power display on the communication option and FR-PU07 during power driving and regenerative driving.

REMARKS

- Input power (with regenerative display) (*Pr.52* ="10") cannot be assigned to a FM/AM analog output terminal.

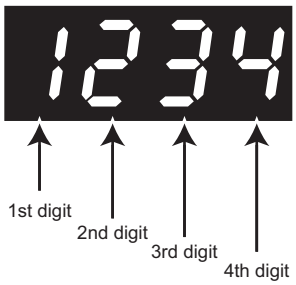
(5) Cumulative energization time monitor*(Pr. 47)*

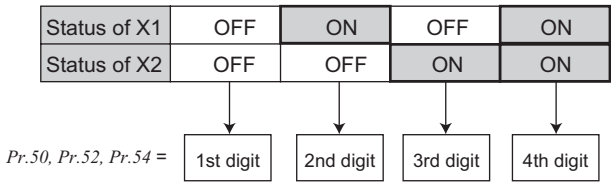
- On the cumulative energization time monitor (*Pr. 52* = "9"), the energization time has been cumulated every hour since the shipment of the converter.
- If the number of monitor value exceeds 65535, it is added up from 0. You can check how many times the cumulative energization time monitor exceeded 65535h with *Pr. 47*.

(6) Monitor switching with input terminal*(Pr. 50, Pr. 52, Pr. 54)*

- Monitoring item can be switched by ON/OFF of terminals X1 and X2.
- By setting 1 to 4 to the four digits of *Pr. 52 (Pr. 54, Pr. 50)*, monitor can be switched by the terminals. Number set in each digits represents the following monitor.

Pr. 50, Pr. 52, Pr. 54 Setting	Monitoring Item
1	Input current monitor
2	Bus voltage monitor
3	Input voltage monitor
4	Input power monitor





- In the initial setting (1234), the monitor changes according to the input terminal status as shown below.

X1	OFF	ON	OFF	ON
X2	OFF	OFF	ON	ON
Monitoring item	1 Input current monitor	2 Bus voltage monitor	3 Input voltage monitor	4 Input power monitor

3.4.14 Operation selection at instantaneous power failure (Pr. 57)

When an instantaneous power failure occurs, the converter can restart at the power restoration.

Parameter Number	Name	Initial value	Setting range	Description
57	Restart selection	9999	0	Restarts at the power restoration after an instantaneous power failure
			9999	Does not restart

- If restart after instantaneous power failure is activated at the inverter side, set *Pr. 57 Restart selection* = "0" at the converter side. When *Pr. 57*="9999," the inverter output is stopped by the fault signal "E.IPF" from the converter even though the automatic restart after instantaneous power failure is activated in the inverter.

⚠ CAUTION

⚠ **The motor and machine will start suddenly after occurrence of an instantaneous power failure (after the reset time has elapsed). Stay away from the motor and machine when automatic restart after instantaneous power failure has been selected.**

If the automatic restart after instantaneous power failure function has been selected, apply the CAUTION stickers, which are supplied with the Inverter Manual, to easily visible places.

3.4.15 Free parameter (Pr. 58, Pr. 59)

You can input any number within the setting range of 0 to 9999.
For example, the number can be used:

- As a unit number when multiple units are used.
- As a pattern number for each operation application when multiple units are used.
- As the year and month of introduction or inspection.

Parameter Number	Name	Initial value	Setting range	Description
58	Free parameter 1	9999	0 to 9999	Desired values can be input. Data is held even if the converter power is turned OFF.
59	Free parameter 2	9999	0 to 9999	

REMARKS

Pr. 58 and Pr. 59 do not influence the operation of the converter.

3.4.16 Key lock selection of operation panel(Pr. 61)

Key operation of the operation panel can be disabled.

Parameter Number	Name	Initial value	Setting range	Description
61	**Key lock operation selection**	0	0	Key lock invalid
			10	Key lock valid

- Setting dial and key operation can be set invalid to avoid unintended changes to parameters.
- Set "10" to *Pr. 61*, and hold MODE for 2s to make the setting dial and key operation invalid and to change the display to the monitor display.
- When the setting dial and key operation are invalid, HOLd appears on the operation panel. If dial or key operation is attempted while dial and key operation is invalid, HOLd appears. (When the setting dial or key operation is not performed for 2s, the monitor display appears.)
- To make the setting dial and key operation valid again, press MODE for 2s.

REMARKS

- Even when the setting dial and key operation are invalid, reset by STOP RESET at a converter trip is still valid.
- Switching of monitor is not available.

NOTE

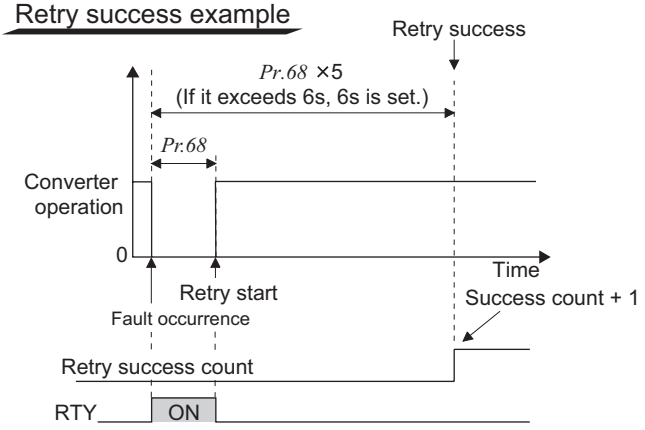
- **Release the operation lock to release the PU stop by key operation.**

3.4.17 Retry function (Pr. 65, Pr. 67 to Pr. 69)

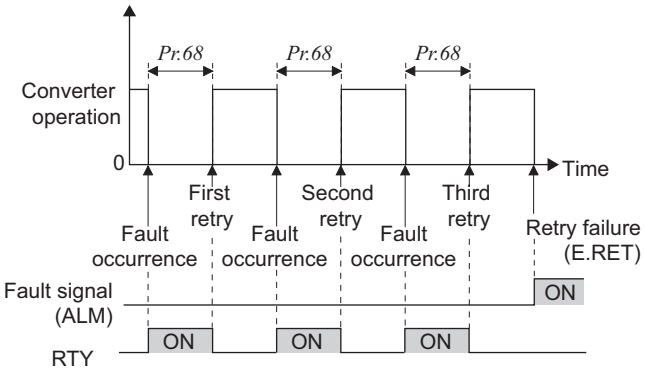
If a fault occurs, the converter resets itself automatically to restart. Fault-activating retries can be also selected.

Parameter Number	Name	Initial value	Setting range	Description
65	**Retry selection**	0	0 to 4	A fault for retry can be selected. *(Refer to the table in the next page.)*
67	**Number of retries at fault occurrence**	0	0	No retry function
			1 to 10	Set the number of retries at a fault occurrence. A fault output is not provided during the retry operation.
			101 to 110	Set the number of retries at a fault occurrence.(The setting value minus 100 is the number of retries.) A fault output is provided during the retry operation.
68	**Retry waiting time**	1s	0 to 360s	Set the waiting time from when a converter fault occurs until a retry is made.
69	**Retry count display erase**	0	0	Clear the number of restarts succeeded by retries.

Retry success example



Retry failure example



- Retry operation automatically resets a fault and restarts the converter when the time set in *Pr. 68* elapses after the converter trip.
- Retry operation is performed when *Pr. 67* ≠ "0."Set the number of retries at a fault occurrence to *Pr. 67*.
- When retries fail consecutively more than the number of times set in *Pr. 67*, a retry count excess fault (E.RET) occurs, resulting in a converter trip. (Refer to the Retry failure example.)
- Use *Pr. 68* to set the waiting time from when the converter trips until a retry is made in the range of 0 to 360s. (When the setting value is "0s", the actual time is 0.1s.)
- Reading the *Pr. 69* value provides the cumulative number of successful restart times made by retries.
  The cumulative count in *Pr. 69* increases by 1 when a retry is successful. Retry is regarded as successful when normal operation continues without a fault for 6s or *Pr. 68* setting multiplied by four or more, whichever is shorter.
  (When retry is successful, cumulative number of retry failure is cleared.)
- Writing "0" in *Pr. 69* clears the cumulative count.
  During a retry, RTY signal is ON. For RTY signal, assign the function by setting "11 (positive logic)" or "111(negative logic)" in any of *Pr. 11 to Pr. 16 (output terminal function selection)*.

NOTE

Changing the terminal assignment using *Pr. 11 to Pr. 16 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of each terminal.

• Using *Pr. 65*, you can select the fault that will cause a retry. No retry will be made for the fault not indicated. (*Refer to page 124* for the fault description.)

● indicates the faults selected for retry.

Fault for Retry	*Pr. 65* Setting				
	0	1	2	3	4
E.OC2	●	●		●	●
E.OV2	●		●	●	●
E.THT	●				
E.IPF	●				●
E.UVT	●				●
E.OHT	●				
E.OP3	●				●
E.CDO	●				●
E.ILF	●				●
E.8	●				●

NOTE

- **The data stored as the error reset for retry is only that of the fault which occurred the first time.**
- **When an converter fault is reset by the retry function at the retry time, the accumulated data of the electronic thermal relay function, etc. are not cleared.(Different from the power-ON reset.)**

⚠ CAUTION

⚠ **Stay away from the motor and machine when the converter trips while the retry function is selected. Motor and machine will start suddenly (after the reset time has elapsed) after a converter trip.**
If the retry function has been selected, apply the CAUTION stickers, which are supplied with the Inverter Manual, to easily visible places.

3.4.18 Reset selection/disconnected PU detection/PU stop selection (Pr. 75)

You can select the reset input acceptance, disconnected PU (FR-DU07-CNV/FR-PU07) connector detection function and PU stop function.

Parameter Number	Name	Initial Value	Setting Range	Description
75	**Reset selection/disconnected PU detection/PU stop selection**	14	0 to 3, 14 to 17	For the initial setting, reset is always enabled, without disconnected PU detection, and with PU stop function are set.

•The *Pr. 75* value can be set any time. Also, if parameter (all) clear is performed, this setting will not return to the initial value.

Pr. 75 Setting	Reset Selection	Disconnected PU detection	PU Stop Selection
0	Reset input always enabled	If the PU is disconnected, operation will be continued.	Stop by STOP RESET is not available.
1	Reset input is enabled only when a fault occurs.		
2	Reset input always enabled	When the PU is disconnected, the converter trips.	
3	Reset input is enabled only when a fault occurs.		
14 (Initial setting)	Reset input always enabled	If the PU is disconnected, operation will be continued.	Pressing STOP RESET decelerates the motor to a stop.
15	Reset input is enabled only when a fault occurs.		
16	Reset input always enabled	When the PU is disconnected, the converter trips.	
17	Reset input is enabled only when a fault occurs.		

(1) Reset selection

- You can select the enable condition of reset function (RES signal, reset command through communication) input.
- When *Pr. 75* is set to any of "1, 3, 15, 17", a reset can be input only when the converter is tripped.

NOTE

- **Inputting the reset signal (RES) during operation also resets the inverter. The motor coasts since the inverter being reset shuts off the output. Also, the cumulative value of the electronic thermal relay is cleared.**
- **The reset key of the parameters is only valid when the converter is tripped, independently of the *Pr. 75* setting.**

(2) Disconnected PU detection

- This function detects that the PU (FR-DU07-CNV/FR-PU07) has been disconnected from the converter for 1s or longer and causes the converter to provide a fault output (E.PUE) and to trip.
- When *Pr. 75* is set to any of "0, 1, 14, 15", operation continues if the PU is disconnected.

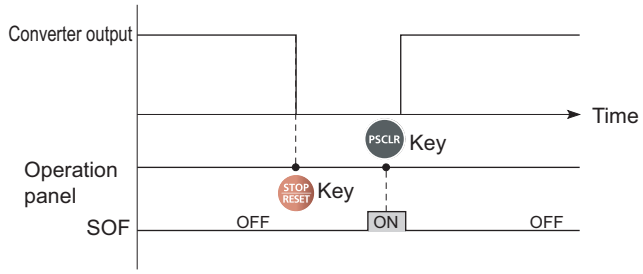
NOTE

- **When the PU has been disconnected since before power-ON, it is not judged as a fault.**
- **To make a restart, confirm that the PU is connected and then reset the converter.**
- **When RS-485 communication operation is performed through the PU connector, the reset selection/PU stop selection function is valid but the disconnected PU detection function is invalid.**

(3) PU stop selection

- When *Pr. 75* is set to any of "14 to 17", STOP RESET input from the PU stops the converter.
- When the converter is stopped by the PU stop function, "PS" is displayed. A fault output is not provided.

(4) How to restart the motor stopped by STOP RESET input from the PU (PU stop (PS) reset method)



Stop/restart example for external operation

(a) Operation panel (FR-DU07-CNV)

1) Turn SOF signal ON and stop the converter operation.
2) Press PSCLR
   ••••••(PS reset)
3) Turn SOF signal OFF and restart the converter operation.

(b) Parameter unit (FR-PU07)

1) Turn SOF signal ON and stop the converter operation.
2) Press EXT
   ••••••(PS reset)
3) Turn SOF signal OFF and restart the converter operation.

- The motor can be restarted by making a reset using a power supply reset or RES signal.

⚠ CAUTION

⚠ Do not reset the converter while the inverter start signal is being input.
Otherwise, the motor will start suddenly after resetting, leading to potentially hazardous conditions.

3.4.19 Parameter write disable selection (Pr. 77)

You can select whether to enable the writing to various parameters or not. Use this function to prevent parameter values from being rewritten by misoperation.

Parameter Number	Name	Initial Value	Setting Range	Description
77	Parameter write selection	2	1	Parameter write is disabled.
			2	Parameter write is enabled regardless of operation status.

Pr. 77 can always be set independently from the operation status.

(1) Disable parameter write *(Setting "1")*

- Parameter write is disabled. (Read is enabled.)
- Parameter clear and all parameter clear cannot be performed, either.
- The parameters given on the right can be written even when *Pr. 77* = "1".

Parameter Number	Name
0	Simple mode selection
75	Reset selection/disconnected PU detection/ PU stop selection
77	Parameter write selection

(2) Write parameters during operation *(Setting "2")*

- Parameter can be always written.
- The following parameter cannot be written when the converter is running with *Pr. 77* = "2". Stop the converter when changing the parameter setting.

Parameter Number	Name
10	RDY signal logic selection

3.4.20 Current control (Pr. 82, Pr. 83)

This function controls current to be as commanded.
Operation should be stable in the initial setting, but adjust the following parameters when current fluctuation occurs due to the environment such as power source condition.

Parameter Number	Name	Initial Value	Setting Range	Description
82	**Current control proportional gain**	100%	0 to 200%	Set the proportional gain for the current control. Increasing the setting value reduces the current fluctuation caused by external disturbance.
83	**Current control integral gain**	100%	0 to 200%	Set the integral gain for the current control. Increasing the setting value shortens the recovery time from the current fluctuation caused by external disturbance.

- Adjust the fluctuation range of current by setting *Pr. 80*.
  Increasing the setting value reduces the current fluctuation caused by external disturbance.
- Adjust the recovery time to the commanded current after a current fluctuation by setting *Pr. 83*.
  Increasing the setting value shortens the recovery time from the current fluctuation caused by external disturbance.

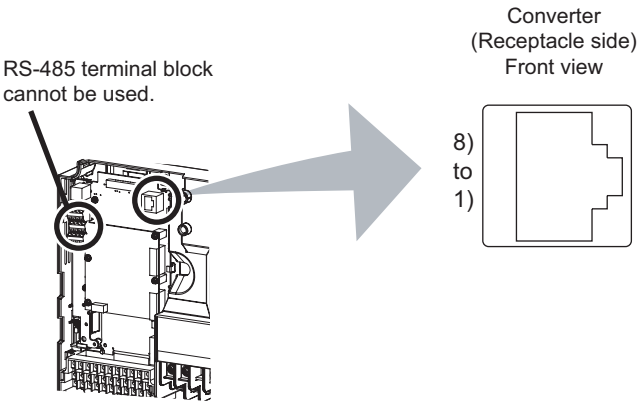
NOTE

- **Setting *Pr. 82* too large makes the operation unstable.**
- **Setting only *Pr. 83* too large makes the operation unstable.**

3.4.21 Wiring and configuration of PU connector

Using the PU connector, you can perform communication operation from a personal computer, etc.
When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run and monitor the converter or read and write to parameters.

(1) PU connector pin-outs



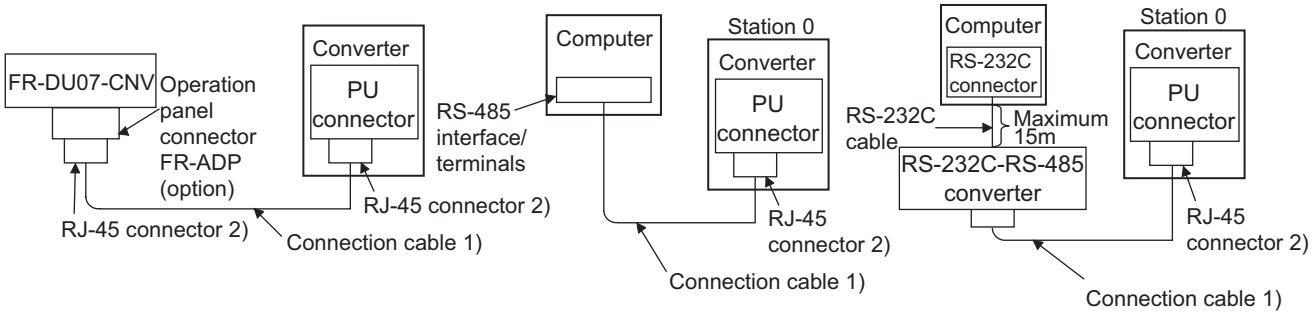
Pin Number	Name	Description
1)	SG	Earth (ground) (connected to terminal 5)
2)	—	Operation panel power supply
3)	RDA	Converter receive+
4)	SDB	Converter send-
5)	SDA	Converter send+
6)	RDB	Converter receive-
7)	SG	Earth (ground) (connected to terminal 5)
8)	—	Operation panel power supply

NOTE

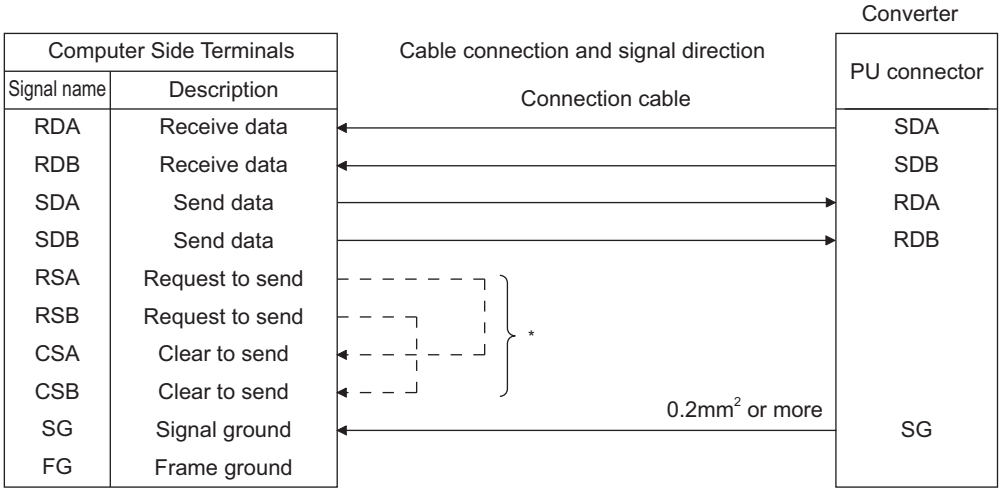
- **Pins No. 2 and No. 8 provide power to the operation panel or parameter unit. Do not use these pins for RS-485 communication.**
- **Do not connect the PU connector to the computer's LAN board, FAX modem socket or telephone modular connector. The product could be damaged due to differences in electrical specifications.**

(2) Wiring and configuration of PU connector communication system

● **System configuration**



● **Wiring of RS-485 computer**



* Make connection in accordance with the Instruction Manual of the computer to be used with.
Fully check the terminal numbers of the computer since they vary with the model.

REMARKS

- Refer to the following when fabricating the cable on the user side.
  Product available on the market (as of Jan. 2010)

	Product	Type	Manufacturer
1)	Communication cable	SGLPEV-T (Cat5e/300m) 24AWG × 4P *	Mitsubishi Cable Industries, Ltd.
2)	RJ-45 connector	5-554720-3	Tyco Electronics

* Do not use pins No. 2 and No. 8 of the communication cable.

3.4.22 Initial settings and specifications of RS-485 communication (Pr. 117 to Pr. 124)

This function is used to perform required settings for RS-485 communication between the converter and personal computer.

- Use PU connector of the converter for communication.
- You can perform parameter setting, monitoring, etc. using Mitsubishi inverter protocol.
- To make communication between a personal computer and a converter, initialization of the communication specifications must be made to the converter.
  Data communication cannot be made if the initial settings are not made or there is any setting error.

[Parameters related to PU connector communication]

Parameter Number	Name	Initial Value	Setting Range	Description	
117	**PU communication station number**	0	0 to 31	Converter station number specification Set the converter station numbers when two or more converters are connected to one personal computer.	
118	**PU communication speed**	192	48, 96, 192, 384	Set the communication speed. The setting value × 100 equals the communication speed. For example, if 192 is set, the communication speed is 19200bps.	
119	**PU communication stop bit length**	1		Stop bit length	Data length
			0	1bit	8 bits
			1	2 bits	
			10	1bit	7 bits
			11	2 bits	
120	**PU communication parity check**	2	0	Without parity check	
			1	With parity check at odd numbers	
			2	With parity check at even numbers	
121	**Number of PU communication retries**	1	0 to 10	Set the permissible number of retries for unsuccessful data reception. If it is still unsuccessful after the permissible number of retries, the converter stops retrying communication.	
			9999	The converter does not retry communication even when the communication is unsuccessful.	
123	**PU communication waiting time setting**	9999	0 to 150ms	Set the waiting time between data transmission to the converter and the response.	
			9999	Set with communication data.	
124	**PU communication CR/LF selection**	1	0	Without CR/LF	
			1	With CR	
			2	With CR/LF	

NOTE

- **Always reset the converter after making the initial settings of the parameters. After you change the communication-related parameters, communication cannot be made until the converter is reset.**

3.4.23 Mitsubishi inverter protocol (computer link communication)

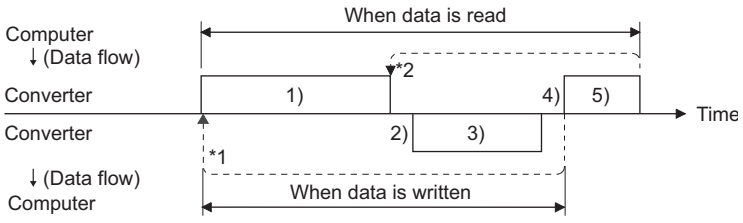
You can perform parameter setting, monitoring, etc. from the PU connector of the converter using the Mitsubishi inverter protocol (computer link communication).

(1) Communication

• The communication specifications are given below.

Item		Description	Related Parameters
Communication protocol		Mitsubishi protocol (computer link)	—
Conforming standard		EIA-485(RS-485)	—
Number of connectable devices		1:N (maximum 32 units), setting is 0 to 31 stations	Pr. 117
Communication speed	PU connector	Selected among 4800/9600/19200/38400bps	Pr. 118
Control procedure		Asynchronous	—
Communication method		Half-duplex	—
Communication	Character system	ASCII (7 bits or 8 bits can be selected.)	Pr. 119
	Start bit	1bit	—
	Stop bit length	1 bit or 2 bits can be selected.	Pr. 119
	Parity check	Check (with even or odd parity) or no check can be selected.	Pr. 120
	Error check	Sum code check	—
	Terminator	CR/LF (presence/absence selectable)	Pr. 124
Waiting time setting		Selectable between presence and absence	Pr. 123

(2) Communication procedure



• Data communication between the computer and converter is made in the following procedure.

1) Request data is sent from the computer to the converter. (The converter will not send data unless requested.)
2) After waiting for the waiting time,
3) The converter sends reply data to the computer in response to the computer request.
4) After waiting for the converter data processing time,
5) An answer from the computer in response to reply data 3) of the converter is transmitted. (Even if 5) is not sent, subsequent communication is made properly.)

*1 If a data error is detected and a retry must be made, perform retry operation with the user program. The converter stops retrying and outputs the LF signal when the number of consecutive retries exceeds the parameter setting.

*2 On receipt of a data error occurrence, the converter returns reply data 3) to the computer again. The converter stops retrying and outputs the LF signal when the number of consecutive data errors exceeds the number set in the parameter.

(3) Communication operation presence/absence and data format types

• Data communication between the computer and converter is made in ASCII code (hexadecimal code).
• Communication operation presence/absence and data format types are as follows.

No.	Operation		Parameter/ Monitor Write	Converter Reset	Monitor	Parameter Read
1)	Communication request is sent to the converter in accordance with the user program in the computer.		A A1	A	B	B
2)	Converter data processing time		Present	Absent	Present	Present
3)	Reply data from the converter (Data 1) is checked for an error)	No error *1 (Request accepted)	C	C*2	E E1	E
		With error (Request rejected)	D	D*2	D	D
4)	Computer processing delay time		10ms or more			
5)	Answer from computer in response to reply data 3). (Data 3) is checked for error)	No error *1 (No converter processing)	Absent	Absent	Absent (C)	Absent (C)
		With error (Converter outputs 3) again.)	Absent	Absent	F	F

*1 In the communication request data from the computer to the converter, 10ms or more is also required after "no data error (ACK)". *(Refer to page 97)*
*2 Reply from the converter to the converter reset request can be selected. *(Refer to age 102)*

• Data writing format

Communication request data from the computer to the converter 1)

Format	Number of Characters												
	1	2	3	4	5	6	7	8	9	10	11	12	13
A	ENQ *1	Station number *2		Instruction code		*3	Data				Sum check		*4
A1	ENQ *1	Station number *2		Instruction code		*3	Data		Sum check		*4		

Reply data from the converter to the computer 3) (No data error detected)

Format	Number of Characters			
	1	2	3	4
C	ACK *1	Station number *2		*4

Reply data from the converter to the computer 3) (With data error)

Format	Number of Characters				
	1	2	3	4	5
D	NAK *1	Station number *2		Error code	*4

*1 Indicate a control code
*2 Specify the station numbers between H00 and H1F (stations 0 to 31) in hexadecimal.
*3 Waiting time
When *Pr.123* (Waiting time setting) ≠ 9999, create a communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)
*4 CR, LF code
When data is transmitted from the computer to the converter, codes CR (carriage return) and LF (line feed) are automatically set at the end of a data group on some computers. In this case, setting must also be made on the converter according to the computer. Whether the CR and LF codes will be present or absent can be selected using *Pr. 124* (CR/LF selection).

• Data reading format

Communication request data from the computer to the converter 1)

Format	Number of Characters								
	1	2	3	4	5	6	7	8	9
B	ENQ *1	Station number *2		Instruction code		*3	Sum check		*4

Reply data from the converter to the computer 3) (No data error detected)

Format	Number of Characters										
	1	2	3	4	5	6	7	8	9	10	11
E	STX *1	Station number *2		Read data				ETX *1	Sum check		*4
E1	STX *1	Station number *2		Read data		ETX *1	Sum check		*4		

Reply data from the converter to the computer 3) (With data error)

Format	Number of Characters				
	1	2	3	4	5
D	NAK *1	Station number *2		Error code	*4

Send data from the computer to the converter 5)

Format	Number of Characters			
	1	2	3	4
C (Without data error)	ACK *1	Station number *2		*4
F (With data error)	NAK *1	Station number *2		*4

*1 Indicate a control code

*2 Specify the station numbers between H00 and H1F (stations 0 to 31) in hexadecimal.

*3 Waiting time
When *Pr.123* (Waiting time setting) ≠ 9999, create a communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)

*4 CR, LF code
When data is transmitted from the computer to the converter, codes CR (carriage return) and LF (line feed) are automatically set at the end of a data group on some computers. In this case, setting must also be made on the converter according to the computer. Whether the CR and LF codes will be present or absent can be selected using *Pr. 124* (CR/LF selection).

(4) Data definitions

1) Control code

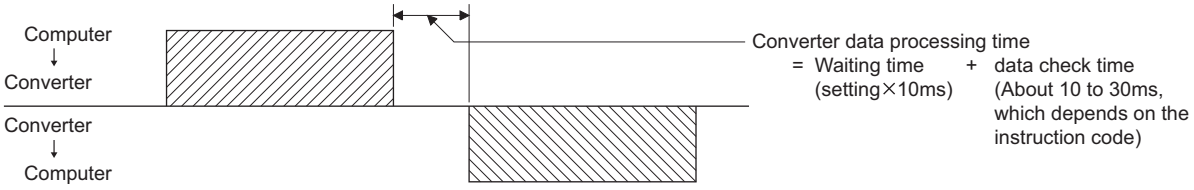
Signal Name	ASCII Code	Description
STX	H02	Start Of Text (Start of data)
ETX	H03	End Of Text (End of data)
ENQ	H05	Enquiry (Communication request)
ACK	H06	Acknowledge (No data error detected)
LF	H0A	Line Feed
CR	H0D	Carriage Return
NAK	H15	Negative Acknowledge (Data error detected)

2) Station number
Specify the station number of the converter which communicates with the computer.

3) Instruction code
Specify the processing request, e.g. operation or monitoring, given by the computer to the converter. Hence, the converter can be run and monitored in various ways by specifying the instruction code appropriately. *(Refer to page 102)*

4) Data
Indicates the data such as frequency and parameters transferred to and from the converter. The definitions and ranges of set data are determined in accordance with the instruction codes. *(Refer to page 102)*

5) Waiting time
Specify the waiting time between the receipt of data at the converter from the computer and the transmission of reply data. Set the waiting time in accordance with the response time of the computer in the range of 0 to 150ms in 10ms increments. (Example; 1:10ms, 2:20ms)



REMARKS

- When *Pr. 123 (waiting time setting)* ≠ 9999, create the communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)
- The data check time varies by the instruction code. *(Refer to page 98)*

6) Sum check code
The sum check code is a 2-digit ASCII (hexadecimal) representing the lower 1 byte (8 bits) of the sum (binary) derived from the checked ASCII data.

(Example 1)
Computer → Converter

	ENQ	Station number		Instruction code		*Waiting time	Data				Sum check code		
		0	1	E	1	1	0	7	A	D	F	4	← Binary code
ASCII Code →	H05	H30	H31	H45	H31	H31	H30	H37	H41	H44	H46	H34	

H30+H31+H45+H31+H31+H30+H37+H41+H44
= H1F4
Sum

* When the *Pr. 123 Waiting time setting* ≠ "9999", create the communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)

(Example 2)
Converter → Computer

	STX	Station number		Data read				ETX	Sum check code		
		0	1	1	7	7	0		3	0	← Binary code
ASCII Code →	H02	H30	H31	H31	H37	H37	H30	H03	H33	H30	

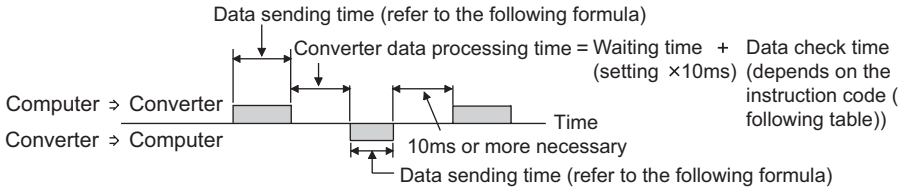
H30+H31+H31+H37+H37+H30
= H130
Sum

7) Error code

If any error is found in the data received by the converter, its error definition is sent back to the computer together with the NAK code.

Error Code	Error Item	Error Description	Converter Operation
H0	Computer NAK error	The number of errors consecutively detected in communication request data from the computer is greater than permissible number of retries.	If errors occur consecutively and exceed the number of the permissible number of retries (*Pr.121*), the converter outputs the alarm (LF).
H1	Parity error	The parity check result does not match the specified parity.	
H2	Sum check error	The sum check code in the computer does not match that of the data received by the converter.	
H3	Protocol error	The data received by the converter has a grammatical mistake. Or, data receive is not completed within the predetermined time. CR or LF is not as set in the parameter.	
H4	Framing error	The stop bit length differs from the initial setting.	
H5	Overrun error	New data has been sent by the computer before the converter completes receiving the preceding data.	
H6	————	————	————
H7	Character error	The character received is invalid (other than 0 to 9, A to F, control code).	Does not accept the received data.
H8	————	————	————
H9	————	————	————
HA	Mode error	Parameter write was attempted in other than the computer link operation mode, when the operation command source is not present, or when parameter write is disabled.	Does not accept the received data.
HB	Instruction code error	The specified instruction code does not exist.	
HC	Data range error	Invalid data has been specified for parameter write, etc.	
HD	————	————	————
HE	————	————	————
HF	————	————	————

(5) Response time


Data sending time (refer to the following formula)
Converter data processing time = Waiting time (setting ×10ms) + Data check time (depends on the instruction code (following table))
Computer ⇒ Converter
Converter ⇒ Computer
Time
10ms or more necessary
Data sending time (refer to the following formula)

[Formula for data transmission time]

$$\frac{1}{\text{Communication speed (bps)}} \times \text{Number of data characters} \times \text{Communication (Total number of bits)} = \text{data transmission time (s)}$$

(Refer to page 95)

(Refer to the following.)

●Communication specifications

Name		Number of Bits
Stop bit length		1 bit 2 bits
Data length		7 bits 8 bits
Parity check	Present	1 bit
	Absent	0

In addition to the above, 1 start bit is necessary.

Minimum number of total bits.....9 bits

Maximum number of total bits.....12 bits

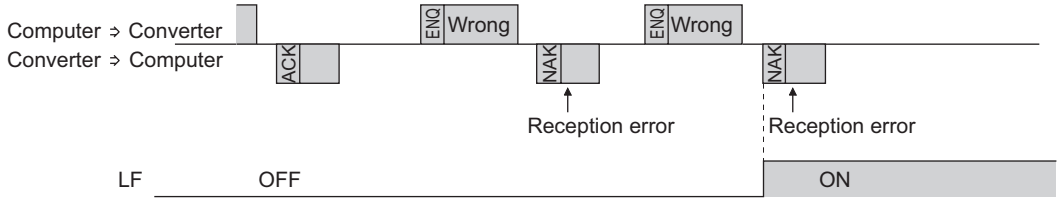
●Data check time

Item	Check Time
Various monitors	< 12ms
Parameter read/write,	< 30ms
Parameter clear / all clear	< 5s
Reset command	No answer

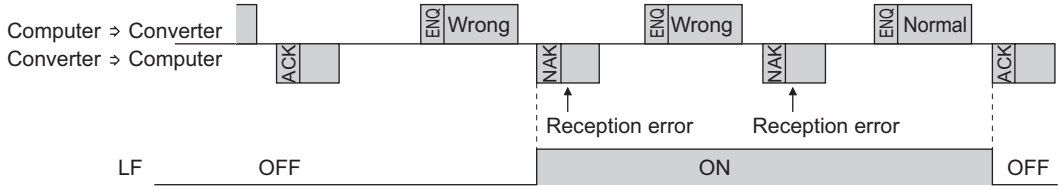
(6) Retry count setting *(Pr. 121)*

- Set the permissible number of retries at data receive error occurrence. (*Refer to page 98* for data receive error for retry.)
- If data receive errors occur consecutively and exceed the permissible number of retries set, the converter outputs the alarm (LF). (The converter does not trip.)
- If "9999" is set, the alarm (LF) is output at a data communication error. (The converter does not trip.)
  For the terminal used for LF signal output, set "98 (positive logic)" or "198 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*.

Example: PU connector communication, *Pr. 121* = "1" (initial value)



Example: PU connector communication, *Pr. 121* = "9999"



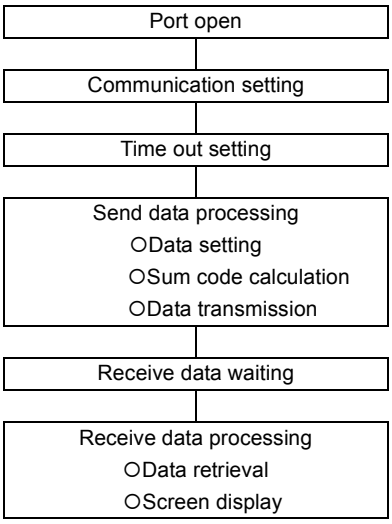
(7) Instructions for the program

1) When data from the computer has any error, the converter does not accept that data. Hence, in the user program, always insert a retry program for data error.
2) All data communication, e.g. run command or monitoring, are started when the computer gives a communication request. The converter does not return any data without the computer's request. Hence, design the program so that the computer gives a data read request for monitoring, etc. as required.
3) Program example
   Example of clearing parameters of the converter

Programming example of Microsoft® Visual C++® (Ver.6.0)

```
#include <stdio.h>
#include <windows.h>

void main(void){
	HANDLE		hCom;		// Communication handle
	DCB		hDcb;		// Structure for communication setting
	COMMTIMEOUTS		hTim;	// Structure for time out setting

	char		szTx[0x10];		// Send buffer
	char		szRx[0x10];		// Receive buffer
	char		szCommand[0x10];// Command
	int		nTx,nRx;		// For buffer size storing
	int		nSum;			// For sum code calculation
	BOOL		bRet;
	int		nRet;
	int		i;

	//**** Opens COM1 port****
	hCom = CreateFile ("COM1", (GENERIC_READ | GENERIC_WRITE), 0, NULL, OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, NULL);
	if (hCom != NULL) {
		//**** Makes a communication setting of COM1 port****
		GetCommState(hCom,&hDcb);				// Retrieves current communication information
		hDcb.DCBlength = sizeof(DCB);				// Structure size setting
		hDcb.BaudRate  = 19200;				// Communication speed=19200bps
		hDcb.ByteSize  = 8;					// Data length=8bit
		hDcb.Parity    = 2;					// Even parity
		hDcb.StopBits  = 2;					// Stop bit=2bit
		bRet = SetCommState(hCom,&hDcb);			// Sets the changed communication data
		if (bRet == TRUE) {
			//**** Makes a time out setting of COM1 port****
			Get CommTimeouts(hCom,&hTim);			// Obtains the current time out value
			hTim.WriteTotalTimeoutConstant = 1000;		// Write time out 1s
			hTim.ReadTotalTimeoutConstant  = 1000;		// Read time out 1s
			SetCommTimeouts(hCom,&hTim);			// Changed time out value setting
			//**** Sets a command to clear parameters of the station 1 converter. ****
			sprintf(szCommand,"01FC15A5A");			// Send data (Parameter clear)
			nTx = strlen(szCommand);			//Send data size
			//**** Generates sum code****
			nSum = 0;					// Initialization of sum data
			for (i = 0;i < nTx;i++) {
				nSum += szCommand[i];			// Calculates sum code
				nSum &= (0xff);				// Masks data
			}

			//**** Generates send data****
			memset(szTx,0,sizeof(szTx));			// Initialization of send buffer
			memset(szRx,0,sizeof(szRx));			// Initialization of receive buffer
			sprintf(szTx,"\5%s%02X",szCommand,nSum);// ENQ code+send data+sum code
			nTx = 1 + nTx + 2;				// Number of ENQ code+number of send data+number of sum code

			nRet = WriteFile(hCom,szTx,nTx,&nTx,NULL);
			//**** Sending ****
			if(nRet != 0) {
				nRet = ReadFile(hCom,szRx,sizeof(szRx),&nRx,NULL);
			//**** Receiving ****
				if(nRet != 0) {
					//**** Displays the receive data ****
					for(i = 0;i < nRx;i++) {
						printf("%02X ",(BYTE)szRx[i]);// Consol output of receive data
						// Displays ASCII coder in hexadecimal. Displays 30 when "0"
					}
					printf("\n\r");
				}
			}
		}
		CloseHandle(hCom);					// Close communication port
	}
}
```

General flowchart



⚠ CAUTION

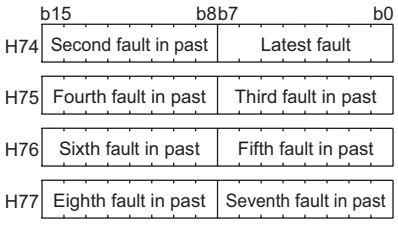
⚠ Always set the communication check time interval before starting operation to prevent hazardous conditions.

⚠ Data communication is not started automatically but is made only once when the computer provides a communication request. If communication is disabled during operation due to signal loss etc., the converter (inverter) cannot be stopped. Turn the RES signal ON or shut off the power supply to coast the motor to a stop and to stop the converter (inverter) operation.

⚠ If communication is broken due to signal cable breakage, computer fault etc., the converter does not detect such a fault. This should be fully noted.

(8) Setting items and set data

After completion of parameter settings, set the instruction codes and data, then start communication from the computer to allow various types of operation control and monitoring.

No.	Item		Read/ Write	Instruction code	Data Description	Number of Data Digits (Format)
1	Monitor	Input current	Read	H6F	H0000 to HFFFF: Input current (hexadecimal) in 0.01A increments (55K or lower) / 0.1A increments (75K or higher)	4 digits (B.E/D)
		Input voltage	Read	H70	H0000 to HFFFF: Input voltage (hexadecimal) in 0.1V increments	4 digits (B.E/D)
		Bus voltage	Read	H71	H0000 to HFFFF: Bus voltage (hexadecimal) in 0.1V increments	4 digits (B.E/D)
		Special monitor	Read	H72	H0000 to HFFFF: Monitor data selected in instruction code HF3	4 digits (B.E/D)
		Special monitor selection No.	Read	H73	H01to H10: Monitor selection data Refer to the special monitor No. table *(page 104)*.	2 digits (B.E1/D)
			Write	HF3		2 digits (A1,C/D)
		Fault record	Read	H74 to H77	H0000 to HFFFF: Two latest fault records  Refer to the fault data table *(page 104)*.	4 digits (B.E/D)
2	Converter status monitor (expansion)		Read	H79	The states of the output signals during power driving, regenerative driving, etc. can be monitored. (*Refer to page 104* for the details.)	4 digits (B.E/D)
	Converter status monitor		Read	H7A		2 digits (B.E1/D)
3	Converter reset		Write	HFD	H9696: resets the converter. • As the converter is reset at the start of communication by the computer, the converter cannot send reply data back to the computer.	4 digits (A,C/D)
					H9966: resets the converter. • When data is sent normally, ACK is returned to the computer, and then the converter is reset.	4 digits (A,D)
4	Faults history batch clear		Write	HF4	H9696: clears the faults history as a batch.	4 digits (A,C/D)

Refer to page 95 for data format (A, A1, B, B1, C, D, E, E1, F).

<table>
<tr><th>No.</th><th>Item</th><th>Read/ Write</th><th>Instruction code</th><th>Data Description</th><th>Number of Data Digits (Format)</th></tr>
<tr><td>5</td><td>Parameter clear
All clear</td><td>Write</td><td>HFC</td><td>All parameters return to the initial settings.
Whether to clear communication parameters or not can be selected according to the data. (○: Clear, ×: Not clear)
Refer to page 174 for parameter clear, all clear, and communication parameters.
<table>
<tr><th>Clear Type</th><th>Data</th><th>Communication Pr.</th></tr>
<tr><td rowspan="2">Parameter clear</td><td>H9696</td><td>○</td></tr>
<tr><td>H5A5A</td><td>× *</td></tr>
<tr><td rowspan="2">All parameter clear</td><td>H9966</td><td>○</td></tr>
<tr><td>H55AA</td><td>× *</td></tr>
</table>
When clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming operation, set the parameters again. Performing clear will clear the instruction code HF3, and HFF settings.
* Turning OFF the power supply while clearing parameters with H5A5A or H55AA also clears the communication parameter settings back to the initial settings.</td><td>4 digits (A,C/D)</td></tr>
<tr><td>6</td><td rowspan="2">Parameter</td><td>Read</td><td>H00 to H5B</td><td rowspan="2">Refer to the instruction code (page 174) and write and/or read parameter values as required.
When setting Pr. 100 and later, link parameter extended setting must be set.</td><td>4 digits (B.E/D)</td></tr>
<tr><td>7</td><td>Write</td><td>H80 to HDB</td><td>4 digits (A,C/D)</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Link parameter extended setting</td><td>Read</td><td>H7F</td><td rowspan="2">Parameter description is changed according to the H00 to H09 setting.
For details of the settings, refer to the instruction code (page 174).</td><td>2 digits (B.E1/D)</td></tr>
<tr><td>Write</td><td>HFF</td><td>2 digits (A1,C/D)</td></tr>
</table>

Refer to page 95 for data format (A, A1, B, B1, C, D, E, E1, F).

REMARKS

- Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999".
- For the instruction codes HFF and HF3, their values are held once written but cleared to zero when an converter reset or all clear is performed.

[Special monitor selection No.]

Refer to *page 82* for details of the monitor description.

Data	Description	Increments
H01	Input current	0.01A/0.1A*1
H02	Input voltage	0.1V
H03	Bus voltage	0.1V
H05	Power supply frequency	0.01Hz
H06	Electronic thermal relay load factor	0.1%

Data	Description	Increments
H07	Input power	0.01kW/ 0.1kW*1
H08	Cumulative power	1kWh
H09	Cumulative energization time	1h

Data	Description	Increments
H0A	Input power*2	0.1kW/ 1kW*1
H0F	Input terminal status *3	—
H10	Output terminal status *4	—

*1 Differ according to capacities. (55K or lower/75K or higher)

*2 The regenerative status cannot be displayed. The regenerative status display is available only on the operation panel (FR-DU07-CNV).

*3 Input terminal monitor details

b15															b0
—	—	—	—	—	RES	—	SOF	—	ROH	X2	X1	—	—	—	—

*4 Output terminal monitor details

b15															b0
—	—	—	—	—	—	—	—	88R	ABC	Y3	Y2	Y1	CVO	RSO	RDY

[Fault data]

Refer to *page 124* for details of fault description.

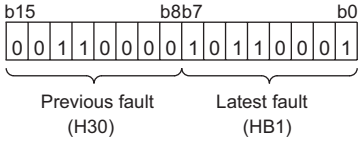
Data	Description
H00	**No fault present**
H11	**E.OC2**
H21	**E.OV2**
H30	**E.THT**
H40	**E.FIN**
H50	**E.IPF**
H51	**E.UVT**
H52	**E.ILF**
H90	**E.OHT**
HA3	**E.OP3**

Data	Description
HB0	**E.PE**
HB1	**E.PUE**
HB2	**E.RET**
HB3	**E.PE2**
HC0	**E.CPU**
HC1	**E.CTE**
HC2	**E.P24**
HC4	**E.CDO**
HC5	**E.IOH**
HF2	**E.2**
HF3	**E.3**

Data	Description
HF6	**E.6**
HF7	**E.7**
HF8	**E.8**
HF9	**E.9**
HFD	**E.13**

Fault record display example (instruction code H74)

For read data H30B1
(Previous fault ..... THT)
(Latest fault ..... OPT)



[Converter status monitor]

Item	Instruction Code	Bit Length	Description	Example
Converter status monitor	H7A	8bit	b0 : RDY(Inverter run permission)* b1 : Power driving b2 : Regenerative driving b3 : RSO (converter reset)* b4 : Y1 (overload)* b5 : Y2 (power supply phase detecting)* b6 : CVO (converter running)* b7 : 88R (input contactor control)	[Example 1] HO2: Power driving b7 b0 0 0 0 0 0 0 1 0 [Example 2] H40: Converter running b7 b0 0 1 0 0 0 0 0 0
Converter status monitor (expansion)	H79	16bit	b0 : RDY (Inverter run permission)* b1 : Power driving b2 : Regenerative driving b3 : RSO (converter reset)* b4 : Y1 (overload)* b5 : Y2 (power supply phase detecting)* b6 : CVO (converter running)* b7 : 88R (input contactor control) b8 : ABC (fault)* b9 : — b10 : — b11 : — b12 : — b13 : — b14 : — b15 : Fault occurrence	[Example 1] HO2: Power driving b15 b0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 H8100: Trip by a fault b15 b0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0

* The signal within parentheses is in the initial status. Definitions change according to the *Pr. 11 to Pr. 16 (output terminal function selection)*.

3.4.24 Initial setting and specification for the CC-Link communication function (Pr.542 to Pr.544)

Set the station number and baud rate required for the CC-Link communication.

Parameter Number	Name	Initial value	Setting range	Description
542*	Communication station number (CC-Link)	1	1 to 64	Set the station number of the converter.
543*	Baud rate (CC-Link)	0	0 to 4	Set the transmission speed.
544*	CC-Link extended setting	0	0, 1, 12	Extend the functions of the remote register.

* Parameters which can be set when the plug-in option (FR-A7NC) is mounted.

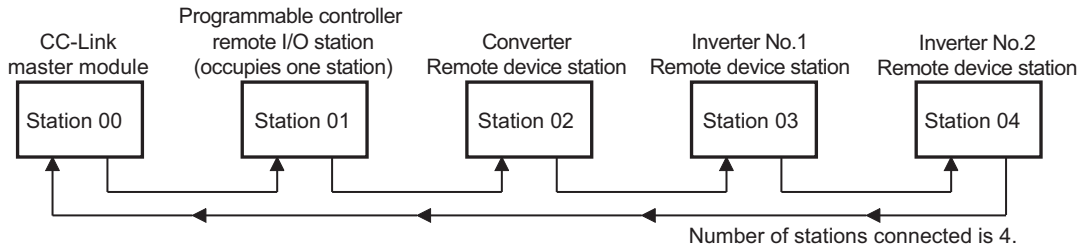
(1) Station number setting *(Pr.542)*

Use *Pr.542 Communication station number (CC-Link)* to set the station number of the converter. Set this parameter within the range of 1 to 64.

NOTE

- **Use different station numbers for different devices. (If different devices have the same station number, the communication cannot be performed properly.)**

Connection example



REMARKS

- Set consecutive numbers for the station numbers. (Do not skip a number in sequence like "station number 1 - station number 2 - station number 4".)
  The station number does not have to match with the physical connection sequence. (There is no problem with having the physical connection sequence like "station number 1 - station number 3 - station number 4 - station number 2".)
- One converter occupies one station (one remote device station).
- "L.ERR" LED on FR-A7NC flickers when a setting is changed. The LED turns OFF when the setting becomes valid by turning the power OFF, then ON, or performing a converter reset.

(2) Baud rate setting *(Pr.543)*

Set the transmission speed. (Refer to the manual for the CC-Link master module for the details of the transmission speed.)

Pr.543 Setting	Transmission speed
0 (Initial setting)	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps

REMARKS

- "L.ERR" LED on FR-A7NC flickers when a setting is changed. The LED turns OFF when the setting becomes valid by turning the power OFF, then ON, or performing a converter reset.

(3) CC-Link extended setting *(Pr.544)*

The functions of the remote register can be extended. Refer to *page 107* for the details of the remote I/O signals and the remote registers.

Pr.544 Setting	CC-Link Ver.	Description
0 (Initial setting)	1	Occupies one station (FR-A5NC compatible)*1
1		Occupies one station
12 *2	2	Occupies one station, double setting

*1 The program used for the conventional inverter series (FR-A5NC) can be used.
The upper 8 bits of RWw2 are not used for the link parameter extended setting.

*2 When using the double setting of the CC-Link Ver.2, station data of the master station must be set to double.
(If the master station is CC-Link Ver.1, this setting is not available.)

REMARKS

- The setting becomes valid after converter reset. (Refer to *page 122* for the converter reset.)

(4) I/O signal list

1) Remote I/O signals (32 points) (For details, refer to *page 109.)*

Device No.	Signal
RYn0	Not used
RYn1	Not used
RYn2	Converter stop (terminal SOF function) *1
RYn3	Monitor switching (terminal X1 function) *1
RYn4	Monitor switching (terminal X2 function) *1
RYn5	Converter reset (terminal RES function) *1
RYn6	ROH inrush resistance overheat detection (terminal ROH function) *1
RYn7	Not used
RYn8	Not used
RYn9	Not used
RYnA	Not used
RYnB	Not used
RYnC	Monitor command
RYnD	Not used
RYnE	Not used
RYnF	Instruction code execution request
RY(n+1)0 to RY(n+1)7	Reserved
RY(n+1)8	Not used (initial data process completion flag)
RY(n+1)9	Not used (initial data process request flag)
RY(n+1)A	Error reset request flag
RY(n+1)B to RY(n+1)F	Reserved

Device No.	Signal
RXn0	Not used
RXn1	Not used
RXn2	Converter ready (inverter run enable signal)
RXn3	Converter reset(terminal RSO function) *2
RXn4	During converter run(terminal CVO function) *2
RXn5	Overload alarm(terminal Y1 function) *2
RXn6	Power supply phase detection(terminal Y2 function) *2
RXn7	Output voltage match (terminal Y3 function) *2
RXn8	Fault(terminal ABC function) *2
RXn9	Not used
RXnA	Not used
RXnB	Not used
RXnC	Monitoring
RXnD	Not used
RXnE	Not used
RXnF	Instruction code execution completion
RX(n+1)0 to RX(n+1)7	Reserved
RX(n+1)8	Not used (initial data process request flag)
RX(n+1)9	Not used (initial data process completion flag)
RX(n+1)A	Error status flag *3
RX(n+1)B	Remote station ready
RX(n+1)C to RX(n+1)F	Reserved

("n" indicates a value determined by the station number setting.)

*1 These signals are set in the initial setting. Using *Pr.3 to Pr.7*, input signals assigned to the device numbers can be changed.
For the available signals, refer to *page 72*.

*2 These signals are set in the initial setting. Using *Pr.11 to Pr.16*, output signals assigned to the device numbers can be changed.
For the available signals, refer to *page 74*.

*3 Output of the error status flag signal depends on the retry function setting.

2)Remote register (For the details, refer to *page 110*.)

●I/O signals when one station (FR-A5NC compatible) in the CC-Link Ver.1 is occupied. (*Pr.544* = "0")

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWwn	Monitor code 2	Monitor code 1
RWwn+1	Not used	
RWwn+2	H00(arbitrary) *1	Instruction Code
RWwn+3	Write data	

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWrn	First monitor value	
RWrn+1	Second monitor value	
RWrn+2	Reply code	
RWrn+3	Read data	

("n" indicates a value determined by the station number setting.)

*1 The upper 8 bits are always H00 even if a value other than H00 is set.

●I/O signals when one station in the CC-Link Ver.1 is occupied. (*Pr.544* = "1")

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWwn	Monitor code 2	Monitor code 1
RWwn+1	Not used	
RWwn+2	Link parameter extended setting	Instruction code
RWwn+3	Write data	

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWrn	First monitor value	
RWrn+1	Second monitor value	
RWrn+2	Reply code	H00
RWrn+3	Read data	

("n" indicates a value determined by the station number setting.)

●I/O signals when the double setting is set in the CC-Link Ver.2 (*Pr.544* = "12")

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWwn	Monitor code 2	Monitor code 1
RWwn+1	Not used	
RWwn+2	Link parameter extended setting	Instruction code
RWwn+3	Write data	
RWwn+4	Monitor code 3	
RWwn+5	Monitor code 4	
RWwn+6	Monitor code 5	
RWwn+7	Monitor code 6	

Device No.	Description	
	Upper 8 Bits	Lower 8 Bits
RWrn	First monitor value	
RWrn+1	Second monitor value	
RWrn+2	Reply code	H00
RWrn+3	Read data	
RWrn+4	Third monitor value	
RWrn+5	Fourth monitor value	
RWrn+6	Fifth monitor value	
RWrn+7	Sixth monitor value	

("n" indicates a value determined by the station number setting.)

(5) Details of the remote I/O signals

The following device numbers are for the station number 1.
For the station number 2 and later, the device numbers are different. (Refer to the manual for the CC-Link master module for the correspondence between device numbers and stations numbers.)

●Output signals (master module → converter (FR-A7NC))

Output signals from the master module are as follows: (Input signals to the converter)

Device No.	Signal	Description
RY2	Converter stop (terminal SOF function) *	The functions assigned to terminals SOF, X1, X2, RES, and ROH are valid.
RY3	Monitor switching (terminal X1 function) *	
RY4	Monitor switching (terminal X2 function) *	
RY5	Converter reset (terminal RES function) *	
RY6	ROH inrush resistance overheat detection (terminal ROH function) *	
RYC	Monitor command	Turning ON the monitor command signal (RYC) sets monitor values to the remote register RWr0, 1, and 4 to 7, and turns ON the monitoring signal (RXC). While the monitor command (RYC) is ON, the monitor values are always updated.
RYF	Instruction code execution request	Turning ON the instruction code execution request signal (RYF) executes the instruction code set in RWw2. The instruction code execution completion signal (RXF) turns ON after the instruction code execution is completed. When an instruction code execution error occurs, a value other than "0" is set in the reply code (RWr2).
RY1A	Error reset request flag	Turning ON the error reset request flag at a converter fault resets the converter and turns OFF the error status flag (RX1A).

* These signals are set in the initial setting. Using *Pr.3 to Pr.7*, input signals assigned to the device numbers can be changed. For the available signals, refer to *page 72*.
Note that X1, X2, RES, OH, and ROH signals cannot be controlled through the network.

●Input signals (converter (FR-A7NC) → master module)

Input signals to the master module are as follows: (Output signals from the converter)

Device No.	Signal	Description
RX2	Inverter run enable signal (RDY signal)	OFF: Converter operation disabled ON: Converter operation enabled
RX3	Converter reset (terminal RSO function) *	The functions assigned to terminals RSO, CVO, Y1, Y2, Y3, and ABC are valid.
RX4	During converter run (terminal CVO function) *	
RX5	Overload alarm (terminal Y1 function) *	
RX6	Power supply phase detection (terminal Y2 function) *	
RX7	Output voltage match (terminal Y3 function) *	
RX8	Fault output (terminal ABC function) *	
RXC	Monitoring	Turning ON the monitor command signal (RYC) sets monitor values to the remote registers RWr0, 1, and 4 to 7, and turns ON this signal. This signal turns OFF when the monitor command signal (RYC) turns OFF.
RXF	Instruction code execution completion	Turning ON the instruction code execution request signal (RYF) executes the instruction code set in RWw2, and after the completion, this signal turns ON. This signal turns OFF when the instruction code execution request (RYF) turns OFF.
RX1A	Error status flag	This signal turns ON at a converter fault (the protective function activated). Output of the error status flag signal depends on the retry function setting.
RX1B	Remote station ready	This signal turns ON when the converter becomes ready after initial setting is completed following a power-ON or a hardware reset. This signal turns OFF at a converter fault (the protective function activated). The signal is used as an interlock during the write to/read from the master module.

* These signals are set in the initial setting. Using *Pr.11 to Pr.16*, output signals assigned to the device numbers can be changed. For the available signals, refer to *page 74*.

(6) Details of the remote register

The following device numbers are for the station number 1.
For the station number 2 and later, the device numbers are different. (Refer to the manual for the CC-Link master module for the correspondence between device numbers and station numbers.)

●Remote register (master module → converter (FR-A7NC))

Remote register definition

Device No.	Remote register	Description
RWw0	Monitor code1/ Monitor code 2	Set the monitor code of the monitoring item. *(Refer to page 104)* Turning ON the RYC signal after setting this register sets the monitor data to RWr0/RWr1.
RWw2	Link parameter extended setting/ Instruction code	Set an instruction code *(refer to page 111)* for an operation such as parameter read/write, alarm reference, and alarm clear. Turning ON the RYF signal after setting this register executes the instruction code. The RXF signal turns ON after the instruction code execution is completed. When a value other than "0" is set to *Pr.544 CC-Link extended setting*, upper 8 bits are used for the link parameter extended setting. Example) Reading of *Pr.300* → The instruction code is 0300H.
RWw3	Write data	Set data for the instruction code set in RWw2. (When required) Turn ON the RYF signal after setting RWw2 and this register. Set "0" when the write data is not required.
RWw4	Monitor code 3	Set the monitor code of the monitoring item. Turning ON the RYC signal after setting this register sets the monitor data to RWr□. (□ indicates a register number. (RWr4 to 7))
RWw5	Monitor code 4	
RWw6	Monitor code 5	
RWw7	Monitor code 6	

●Remote register (converter (FR-A7NC) → master module)

Remote register definition

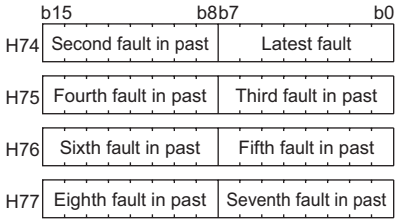
<table>
<tr><th>Device No.</th><th>Remote register</th><th>Description</th></tr>
<tr><td>RWr0</td><td>First monitor value</td><td>Turning ON the RYC signal sets the monitor value to the lower 8 bits of the specified monitor code (RWw0).</td></tr>
<tr><td>RWr1</td><td>Second monitor value</td><td>Turning ON the RYC signal sets the monitor value to the upper 8 bits of the monitor code (RWw0) except when "0" was set to the upper 8 bits.</td></tr>
<tr><td>RWr2</td><td>Reply code</td><td>Turning ON the RYF signal sets the reply code, which corresponds to the instruction code of RWw2. The value "0" is set for a normal reply, and a value other than "0" is set for errors with data, mode, and other.
<table>
<tr><th colspan="2">Reply code</th><th rowspan="2">Description</th><th rowspan="2">Fault description</th></tr>
<tr><th>When Pr.554 = 0</th><th>When Pr.554 ≠ 0</th></tr>
<tr><td>H0000</td><td>H00</td><td>Normal</td><td>No fault (Instruction codes are executed without any fault.)</td></tr>
<tr><td>H0001</td><td>H01</td><td>Write mode fault</td><td>Parameter write is attempted when the converter is running.</td></tr>
<tr><td>H0002</td><td>H02</td><td>Parameter selection fault</td><td>Unregistered code is set.</td></tr>
<tr><td>H0003</td><td>H03</td><td>Setting range fault</td><td>Set data exceeds the permissible range.</td></tr>
</table></td></tr>
<tr><td>RWr3</td><td>Read data</td><td>In a normal reply, a replay code for the instruction code is set.</td></tr>
<tr><td>RWr4</td><td>Third monitor value</td><td rowspan="4">Turning ON the RYC signal sets the monitor values to the specified monitor code (RWw□). (□ indicates a register number. (RWw4 to 7))</td></tr>
<tr><td>RWr5</td><td>Fourth monitor value</td></tr>
<tr><td>RWr6</td><td>Fifth monitor value</td></tr>
<tr><td>RWr7</td><td>Sixth monitor value</td></tr>
</table>

(7) Instruction code definition

Operation control and monitoring can be performed through CC-Link communication by setting the following instruction codes and corresponding data after setting parameters.

Set instruction codes using the remote register (RWw). *(Refer to page 110)*

Definitions read by instruction codes are stored in the remote register (RWr). *(Refer to page 110)*

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Read/ Write</th><th>Instruction code</th><th>Data Description</th></tr>
<tr><td rowspan="7">1</td><td rowspan="7">Monitor</td><td>Input current</td><td>Read</td><td>H6F</td><td>H0000 to HFFFF: Input current (hexadecimal) in 0.01A increments (55K or lower) / 0.1A increments (75K or higher)</td></tr>
<tr><td>Input voltage</td><td>Read</td><td>H70</td><td>H0000 to HFFFF: Input voltage (hexadecimal) in 0.1V increments</td></tr>
<tr><td>Bus voltage</td><td>Read</td><td>H71</td><td>H0000 to HFFFF: Bus voltage (hexadecimal) in 0.1V increments</td></tr>
<tr><td>Special monitor</td><td>Read</td><td>H72</td><td>H0000 to HFFFF: Monitor data selected in the instruction code HF3</td></tr>
<tr><td rowspan="2">Special monitor selection No.</td><td>Read</td><td>H73</td><td rowspan="2">H01 to H10: Monitor selection data
Special monitor selection No.(Refer to page104)
*1 Write data is in hexadecimal, and only two digits are valid. (First two digits are ignored.)</td></tr>
<tr><td>Write</td><td>HF3 *1</td></tr>
<tr><td>Fault record</td><td>Read</td><td>H74 to H77</td><td>H0000 to HFFFF: Two latest fault records
 

Refer to the fault data table (page 104).</td></tr>
<tr><td>2</td><td colspan="2">Converter reset</td><td>Write</td><td>HFD</td><td>H9696: resets the converter.</td></tr>
<tr><td>3</td><td colspan="2">Fault history batch clear</td><td>Write</td><td>HF4</td><td>H9696:clears the faults history as a batch.</td></tr>
<tr><td>4</td><td colspan="2">Parameter clear
All clear</td><td>Write</td><td>HFC</td><td>All parameters return to the initial settings.
Whether to clear communication parameters or not can be selected according to the data.
(○: Clear, ×: Not clear)
Refer to page 174 for parameter clear, all clear, and communication parameters.
<table>
<tr><th>Clear Type</th><th>Data</th><th>Communication Pr.</th></tr>
<tr><td rowspan="2">Parameter clear</td><td>H9696</td><td>○</td></tr>
<tr><td>H5A5A</td><td>×</td></tr>
<tr><td rowspan="2">All parameter clear</td><td>H9966</td><td>○</td></tr>
<tr><td>H55AA</td><td>×</td></tr>
</table>
When clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming the operation, set the parameters again.
Performing clear will clear the instruction code HF3 and HFF settings.</td></tr>
<tr><td>5</td><td colspan="2" rowspan="2">Parameter</td><td>Read</td><td>H00 to H5B</td><td rowspan="2">Refer to the instruction code (page 174) and write and/or read parameter values as required.
When setting Pr. 100 and later, the link parameter extended setting must be set.</td></tr>
<tr><td>6</td><td>Write</td><td>H80 to HDB</td></tr>
<tr><td rowspan="2">7</td><td colspan="2" rowspan="2">Link parameter extended setting</td><td>Read</td><td>H7F</td><td rowspan="2">Parameter description is changed according to the H00 to H09 settings.
For the details of the settings, refer to the instruction code (page 174).</td></tr>
<tr><td>Write</td><td>HFF</td></tr>
</table>

REMARKS

- Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999."
- For the instruction codes HFF and HF3, their values are held once they are written but cleared to zero when an converter reset or all clear is performed.

3.4.25 Operation at a communication error (Pr.500 to Pr.502)

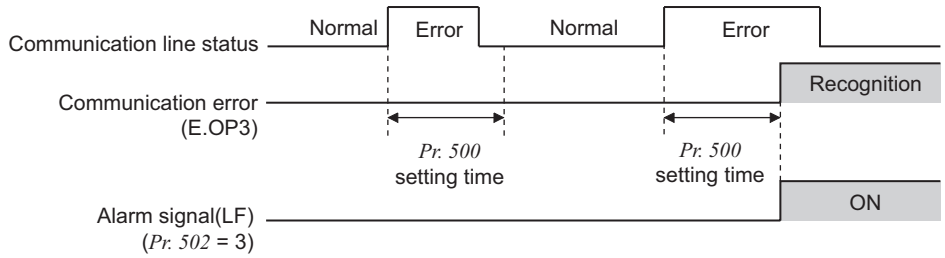
Operation at a communication error in the CC-Link communication can be selected.

Parameter Number	Name	Initial value	Setting range	Description
500*	**Communication error execution waiting time**	0	0 to 999.8s	Set the waiting time for the communication error output after a communication line error occurrence.
501*	**Communication error occurrence count display**	0	0	Displays the cumulative count of communication error occurrences. Write "0" to clear this cumulative count.
502*	**Stop mode selection at communication error**	0	0, 3	Set the converter's operation at a communication line error or an option unit fault.

* Parameters which can be set when the plug-in option (FR-A7NC) is mounted.

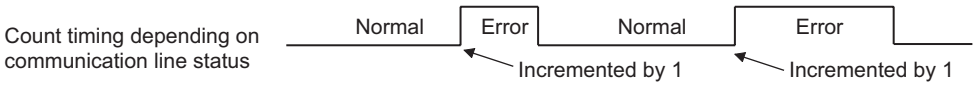
(1) Waiting time for the communication line error output after a communication error *(Pr. 500)*

Waiting time for the communication error output after a communication line error occurrence can be set.
When a communication line error occurs and lasts longer than the time set in *Pr. 500*, it is recognized as a communication error.
If the communication returns to normal within the time, it is not recognized as a communication error, and the operation continues.



(2) Displaying and clearing the communication error count *(Pr.501)*

The cumulative count of communication error occurrences can be displayed. Write "0" to clear this cumulative count.
When a communication line error occurs, the setting of *Pr. 501Communication error occurrence count display* increases by one.



NOTE

- **Communication error count is temporarily stored in the RAM memory. The error count is stored in EEPROM only once per hour. If power reset or converter reset is performed, *Pr.501* setting will be the one that is last stored to EEPROM depending on the reset timing.**

(3) Converter operation at a communication error *(Pr. 502)*

How the converter operates at a communication line error or an option unit fault can be set.

Setting description

●Operation at an error occurrence

Fault description	*Pr.502* Setting	Converter operation	Indication	Fault output
Communication line	0 (initial value), 3	Operation continues*	Normal indication*	Not output*
Communication option	0 (initial value), 3	Operation stops	E.3 lit	Output

* When the communication returns to normal within the time period set in *Pr. 500*, the communication option error (E.OP3) does not occur.

●Operation at error detection after elapse of *Pr. 500*

Fault description	*Pr.502* Setting	Converter operation	Indication	Fault output
Communication line	0 (Initial setting)	Operation stops	E.OP3 lit	Output
	3	Operation continues	Normal indication	Not output
Communication option	0 (initial value), 3	Operation stops	E.3 is lit	Output

●Operation when no error is detected

Fault description	*Pr.502* Setting	Converter operation	Indication	Fault output
Communication line	0 (Initial setting)	Operation kept stopped	E.OP3 kept lit	Kept output
	3	Operation continues	Normal indication	Not output
Communication option	0 (initial value), 3	Operation kept stopped	E.3 kept lit	Kept output

REMARKS

- Communication line error [E.OP3 (fault data: HA3)] is an error that occurs on the communication line. Communication option error [E.3 (fault data:HF3)] is an error that occurs in the communication circuit inside the option.
- Fault output indicates the fault output signal (ABC signal) and alarm bit output.
- When the fault output setting is active, fault records are stored in the fault history.
  When the fault output setting is not active, fault definition is overwritten to the fault history temporarily but not stored.
  After the error is removed, the fault indication is reset, changing the display back to normal, and the last fault is displayed in the fault history.

3.4.26 Communication EEPROM write selection (Pr. 342)

Storage device of the parameter setting can be changed to RAM only from EEPROM+RAM for the parameter writing from the RS-485 communication or the CC-Link communication. Use this setting when parameter settings need to be changed frequently.

Parameter Number	Name	Initial value	Setting range	Description
342	**Communication EEPROM write selection**	0	0	Parameter settings written by communication are written to the EEPROM and RAM.
			1	Parameter settings written by communication are written to the RAM.

- When changing the parameter settings frequently, set "1" in *Pr. 342* to write them to the RAM. The life of the EEPROM will be shorter if parameter write is performed frequently with the setting unchanged from "0 (initial settings)" (EEPROM write).

REMARKS

- Turning OFF the converter's power supply clears the modified parameter settings when *Pr. 342* = "1 (write only to RAM)." Therefore, parameter settings at next power-ON will be the ones that are last stored to EEPROM.

3.4.27 Setting of the parameter unit and operation panel (Pr. 145, Pr. 990, Pr. 991)

Setting of the operation panel and parameter unit can be changed.

Parameter Number	Name	Initial Value	Setting Range	Description
145	PU display language selection	0	0	Japanese
			1	English
			2	German
			3	French
			4	Spanish
			5	Italian
			6	Swedish
			7	Finnish
990	PU buzzer control	1	0	Without buzzer
			1	With buzzer
991	PU contrast adjustment	58	0 to 63	0 : Light ↓ 63: Dark

(1) PU display language selection *(Pr. 145)*

• You can switch the display language of the parameter unit (FR-PU07) to another by setting *Pr. 145*.

REMARKS

• Parameter names and monitor names are always in English regardless of the *Pr. 145* setting.

(2) Buzzer control *(Pr. 990)*

• Setting *Pr. 990* = "1" makes the buzzer "beep" when you press the keys of the operation panel (FR-DU07-CNV) and parameter unit (FR-PU07).

(3) PU contrast adjustment *(Pr. 991)*

• Contrast adjustment of the LCD of the parameter unit (FR-PU07) can be performed.
Decreasing the *Pr. 991* setting value makes the contrast light.

• *Pr. 991* is displayed as a simple mode parameter only when the parameter unit (FR-PU07) is mounted.

3.4.28 Terminal FM and AM calibration (calibration parameter C0 (Pr. 900), C1 (Pr. 901))

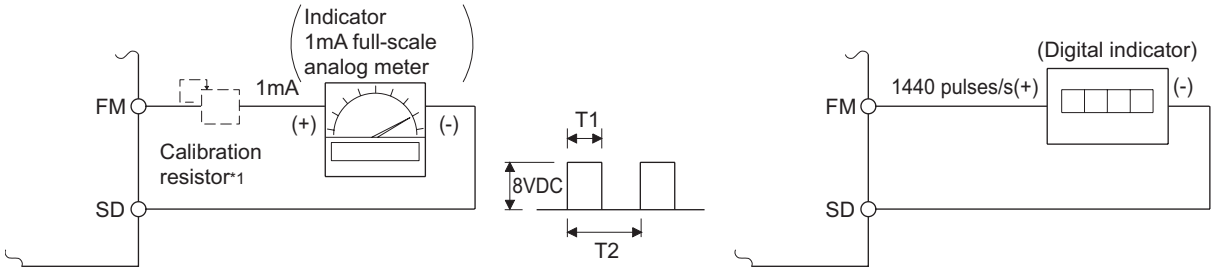
By using the operation panel or parameter unit, you can calibrate terminal FM and AM to full scale deflection.

Parameter Number	Name	Initial Value	Setting Range	Description
C0(900) *	FM terminal calibration	—	—	Calibrates the scale of the meter connected to terminal FM.
C1(901) *	AM terminal calibration	—	—	Calibrates the scale of the analog meter connected to terminal AM.

* The parameter number in parentheses is the one for use with the parameter unit (FR-PU07).

(1) FM terminal calibration *(C0(Pr. 900))*

- The terminal FM is preset to output pulses. By setting *calibration parameter C0 (Pr. 900)*, the meter connected to the converter can be calibrated by parameter setting without use of a calibration resistor.
- Using the pulse train output of the terminal FM, a digital display can be provided to connect a digital counter. The monitor value is 1440 pulses/s output at the full-scale value of monitor description list *(page 82) (Pr. 54 FM terminal function selection)*.



Pulse width T1: Adjust using calibration parameter C0
Pulse cycle T2: Set with *Pr.49, Pr.51, Pr.53, Pr.55, Pr.56*

*1 Not needed when the operation panel (FR-DU07-CNV) or parameter unit (FR-PU07) is used for calibration.
Use a calibration resistor when the indicator (frequency meter) needs to be calibrated by a neighboring device because the indicator is located far from the converter.
However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, perform calibration using the operation panel or parameter unit.

- Calibrate the terminal FM in the following procedure.
  1) Connect an indicator (frequency meter) across terminals FM and SD of the converter. (Note the polarity. The terminal FM is positive.)
  2) When a calibration resistor has already been connected, adjust the resistance to "0" or remove the resistor.
  3) Refer to the monitor description list *(page 82)* and set *Pr. 54*.
     When you selected a monitor that needs full-scale setting (*Pr. 54* = "1 to 3, 5, 7"), preset voltage or current that outputs 1440 pulses/s signal using *Pr. 49, Pr. 51, Pr. 53, Pr. 55, and Pr. 56.*
     At 1440 pulses/s, the meter generally deflects to full-scale.

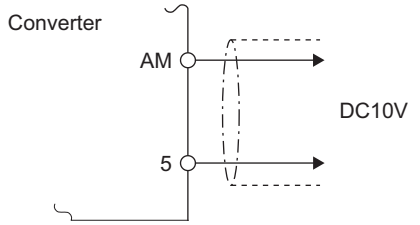
REMARKS

- When outputting a signal such as input current, which cannot be adjusted to 100% easily by an operation, set *Pr. 54* = "21" (reference voltage output) for the calibration. 1440 pulses/s are output from the terminal FM.
- The wiring length of the terminal FM should be 200m at maximum.

NOTE

- **The initial value of the *calibration parameter C0 (Pr. 900)* is set to 1mA full-scale and 1440 pulses/s FM output frequency when *Pr. 49, Pr. 51, Pr. 53, Pr. 55, and Pr. 56* are in initial settings. The maximum pulse train output of terminal FM is 2400 pulses/s.**

(2) AM terminal calibration *(C1(Pr. 901))*



- Terminal AM is initially-set to provide a 10VDC output in the full-scale status of the corresponding monitor item. *Calibration parameter C1 (Pr. 901)* allows the output voltage ratios (gains) to be adjusted according to the meter scale. Note that the maximum output voltage is 10VDC.

• Calibrate the AM terminal in the following procedure.

1) Connect a 0 to 10VDC meter (frequency meter) across converter terminals AM and 5. (Note the polarity. The terminal AM is positive.)
2) Refer to the monitor description list *(page 82)* and set *Pr. 50*.
   When you selected a monitor that needs full-scale setting (*Pr. 50* = "1 to 3, 5, 7"), preset power supply frequency or current that outputs 10V signal using *Pr. 49, Pr. 51, Pr. 53, Pr. 55, and Pr. 56* .

REMARKS

- When outputting a signal such as input current, which cannot be adjusted to 100% easily by an operation, set *Pr. 50* = "21" (reference voltage output) for the calibration. 10VDC is output from the terminal AM.

(3) How to calibrate the terminal FM when using the operation panel (FR-DU07-CNV)

Operation	Display
	(When *Pr. 54* = 5 (Power supply frequency))
1. Confirmation of the RUN indicator and operation mode indicator	0.00 Hz A V MON P.CPY PWR REGEN ..... DRIVE
2. Press MODE to choose the parameter setting mode.	MODE ⇨ P. 0 (The parameter number read previously appears.)
3. Turn dial until C. . . appears.	⇨ C. . . (C0 to C7 setting is enabled.)
4. Press SET to display C - - - .	SET ⇨ C - - -
5. Turn dial until C 0 appears. Set to *C0 FM terminal calibration*.	⇨ C 0
6. Press SET to enable setting.	SET ⇨ 60.00 Hz A V (The monitor set to *Pr. 54 FM terminal function selection* is displayed.)
8. Turn dial (+) to adjust the indicator needle to the desired position.	⇨ Analog indicator
9. Press SET (-). Setting is complete.	SET ⇨ 60.00 Hz A V ⇔ C 0

Flicker...Parameter setting complete!!

- By turning dial, you can read another parameter.
- Press SET to return to the C - - - indication (step 4).
- Press SET twice to show the next parameter (PrCL).

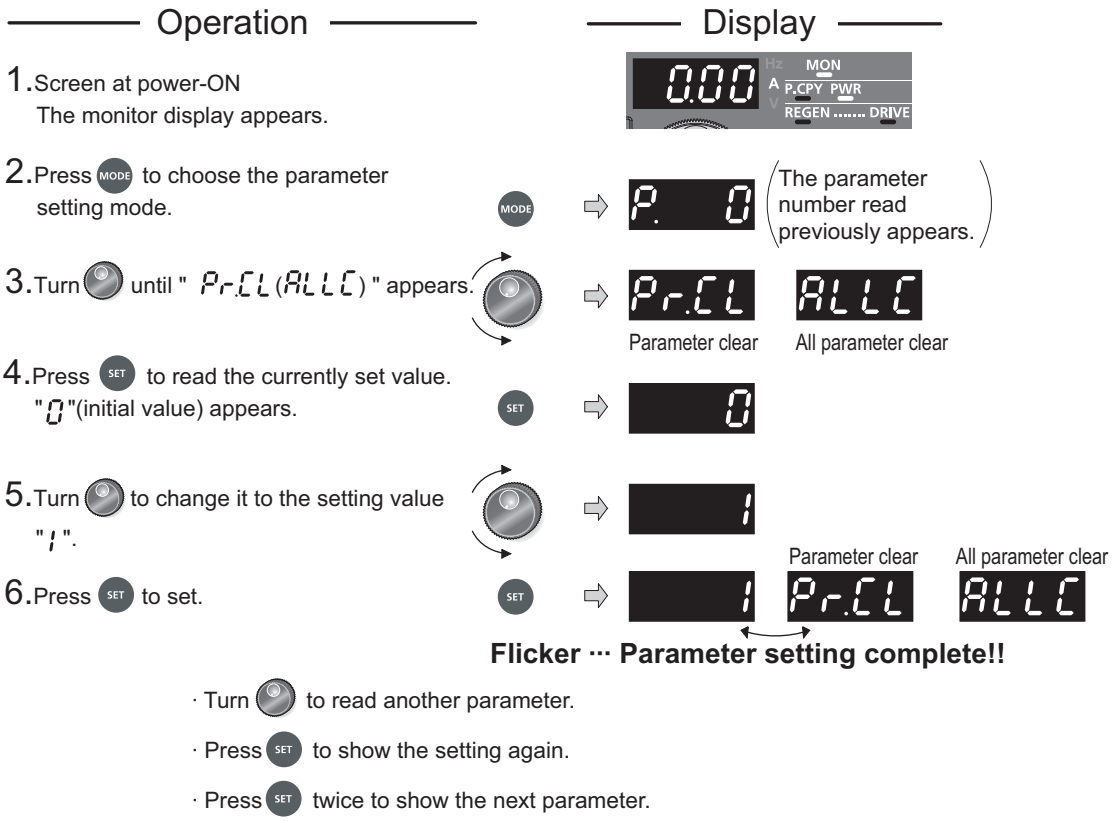
REMARKS

- Calibration can be performed during operation.

3.5 Parameter clear / All parameter clear

POINT

- Set "1" to *Pr. CL Parameter clear, ALLC All parameter clear* to initialize all parameters. (Parameters are not cleared when *Pr. 77 Parameter write selection* = "1.")
- Refer to the parameter list on *page174* for parameters cleared with this operation.



NOTE

- **Converter operation stops during parameter clear and all parameter clear.**
- **After the clear, the converter starts with the initial parameter settings.**

3.6 Parameter copy and parameter verification

PCPY Setting	Description
0	Cancel
1	Copy the source parameters to the operation panel.
2	Write the parameters copied to the operation panel into the destination converter.
3	Verify parameters in the converter and operation panel. *(Refer to page 119)*

REMARKS

- When the copy destination is other than the FR-HC2 series converter or when parameter copy is attempted after the parameter copy reading was stopped, "model error (rE4)" appears.
- Refer to *page 174* for the availability of parameter copy.
- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy writing, write again or check the setting values by the parameter verification.
- After a parameter copy, the operation of the converter is in a stop status. Reset the converter after a parameter copy is completed.

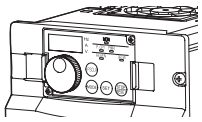
(1) Parameter copy

Parameter settings can be copied to multiple converters.

Operation

1. Connect the operation panel to the copy source converter.
2. Press MODE to choose the parameter setting mode.
3. Turn the dial until PCPY (parameter copy) appears.
4. Press SET to read the currently set value. "0"(initial value) appears.
5. Turn the dial to change it to the setting value "1".
6. Press SET to copy the source parameters to the operation panel.
7. Connect the operation panel to the copy destination converter.
8. After performing the steps 2 to 5, turn the dial to change it to "2".
9. Press SET to write the parameters copied to the operation panel to the destination converter.
10. When copy is completed, "2" and "PCPY" flicker.
11. After writing the parameter values to the copy destination converter, always reset the converter, e.g. switch power OFF once, before starting operation.

Display



MODE ⇨ P. 0 (The parameter number previously read appears.)

⇨ PCPY

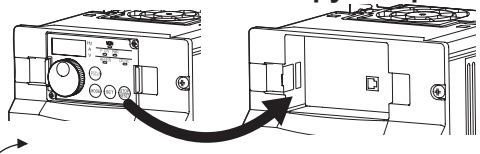
SET ⇨ 0

⇨ 1

SET ⇨ 1 (Flickers for about 30s)

About 30s later ⇨ 1 PCPY

Flicker ··· Parameter copy complete!!



⇨ 2

SET ⇨ 2 (The frequency flickers for about 30s)

⇨ 2 PCPY

Flicker ··· Parameter copy complete!!

? rE1 appears... Why? ☞ Parameter read error. Perform operation from step 3 again.

? rE2 appears... Why? ☞ Parameter write error. Perform operation from step 8 again.

? CP and 0.00 flicker alternately

☞ Appears when parameters are copied between the converter of 55K or lower and 75K or higher.

1. Set "0" (initial value) in *Pr. 0 Simple mode selection*.
2. Set the following setting (initial value) in *Pr. 989 Parameter copy alarm release*.

	55K or lower	75K or higher
Pr. 989 Setting	10	100

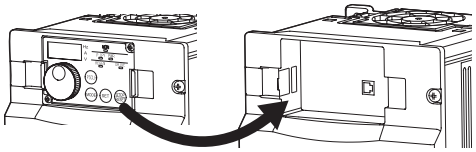
3. Reset *Pr. 50 to Pr. 57*.

(2) Parameter verification

Whether the same parameter values are set in other converters or not can be checked.

Operation — Display

1. Move the operation panel to the converter to be verified.



2. Screen at power-ON
   The monitor display appears.

3. Press MODE to choose the parameter setting mode.

MODE ⇨ P. 0 (The parameter number read previously appears.)

4. Turn dial until PCPY (parameter copy) appears.

5. Press SET to read the currently set value.
   "0"(initial value) appears.

SET ⇨ 0

6. Turn dial to change it to the set value "3"(parameter copy verification mode).

7. Press SET to read the parameter setting of the verified inverter to the operation panel.

SET ⇨ 3 (Flickers for about 30s)

- If different parameters exist, different parameter numbers and rE3 flicker.

- Hold down SET to verify.

SET ⇨ 3 (Flickering)

8. It there is no difference, "PCPY" and "3" flicker to complete verification.

Flicker ··· Parameter verification complete!!

REMARKS

If a model other than the FR-HC2 series is verified, "model error (rE4)" appears.

MEMO

4 PROTECTIVE FUNCTIONS

This chapter provides the "PROTECTIVE FUNCTIONS" of this product.
Always read the instructions before using the equipment.

4.1 Troubleshooting 122
4.2 Reset method of protective function 122
4.3 List of fault and alarm indications 123
4.4 Causes and corrective actions 124
4.5 Correspondences between digital and actual characters 131
4.6 Check and clear of the faults history 132
4.7 Check first when you have a trouble 134

4.1 Troubleshooting

When a fault occurs in the converter, the protective function activates to trip the converter, and the PU display automatically changes to one of the following fault or alarm indications.
If the fault does not correspond to any of the following faults or if you have any other problem, please contact your sales representative.

- Fault or alarm indication ..... When a fault or alarm occurs, the operation panel display automatically switches to a fault or alarm indication.
- Resetting method ..... When a fault occurs, the converter operation is kept stopped. Unless it is reset, the converter cannot restart. *(Refer to page 122)*
- When any fault occurs, take an appropriate corrective action, then reset the converter, and resume the operation. Not doing so may lead to the converter fault and damage.

Converter fault or alarm indications are roughly categorized as below.

(1) Error message
A message regarding operational fault and setting fault by the operation panel (FR-DU07-CNV) and parameter unit (FR-PU07) is displayed. The converter continues its operation.

(2) Warning
The converter continues its operation even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

(3) Alarm
The converter continues its operation. You can also output an alarm signal by making parameter setting.

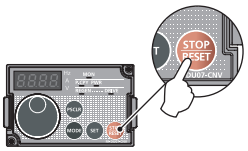
(4) Fault
When a fault occurs, the converter trips and a fault signal is output.

4.2 Reset method of protective function

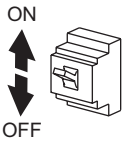
(1) Resetting the converter

The converter can be reset by performing any of the following operations. Note that the internal thermal cumulative value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the converter.
Converter recovers about 1s after the reset.

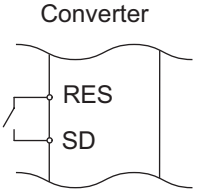
Operation 1: ..... Using the operation panel, press STOP RESET to reset the converter.
(This can be performed only when a fault occurs. *(Refer to page 126 for fault.)*)



Operation 2: ..... Switch power OFF once, then switch it ON again.



Operation 3: ..... Turn ON the reset signal (RES) for more than 0.1s. (If the RES signal is kept ON, "Err." appears (flickers) to indicate that the converter is in a reset status.)



4.3 List of fault and alarm indications

Operation Panel Indication			Name	Refer to page
Error message	E- - -	**E- - -**	Faults history	*132*
	HOLd	**HOLD**	Operation panel lock	*124*
	Er 1	**Er1**	Parameter write error	*124*
	rE 1~ rE4	**rE1 to 4**	Copy operation fault	*124*
	Err.	**Err.**	Error	*125*
Warning	OL	**OL**	Overload signal detection	*125*
	PS	**PS**	PU stop	*125*
	rH	**TH**	Electronic thermal relay pre-alarm	*125*
	nr	**MT**	Maintenance signal output	*126*
	CP	**CP**	Parameter copy	*126*
	SL	**SL**	Power supply not detected	*126*
Alarm	Fn	**FN**	Fan fault	*126*
Fault	E.OC2	**E.OC2**	Overcurrent trip	*126*
	E.Ov2	**E.OV2**	Overvoltage trip	*127*
	E.rHr	**E.THT**	Converter overload trip (electronic thermal relay function)	*127*
	E.Fl n	**E.FIN**	Fin overheat	*127*
	E.l PF	**E.IPF**	Instantaneous power failure	*127*
	E.Uvr	**E.UVT**	Undervoltage	*127*
	E.l LF	**E.ILF**	Input phase loss	*128*
	E.OHr	**E.OHT**	External thermal relay operation	*128*
	E. 2	**E. 2**	HC2 dedicated board disconnection	*128*
	E. 3	**E. 3**	Option fault	*128*
	E.OP3	**E.OP3**	Communication option fault	*128*
	E. PE	**E.PE**	Parameter storage device fault	*129*
	E.PE2	**E.PE2**	Parameter storage device fault	*129*
	E.PUE	**E.PUE**	PU disconnection	*129*
	E.rEr	**E.RET**	Retry count excess	*129*
	E. 6/ E. 7/ E.CPU	**E. 6/ E. 7/ CPU**	CPU fault	*129*
	E. 8	**E. 8**	Input power supply fault 1	*129*
	E. 9	**E. 9**	Input power supply fault 2	*130*
	E.CrE	**E.CTE**	Operation panel power supply short circuit, RS-485 terminal power supply short circuit	*130*
	E.P24	**E.P24**	24VDC power output short circuit	*130*
	E.Cd0	**E.CDO**	Input current detection value exceeded	*130*
	E.l OH	**E.IOH**	Inrush current limit circuit fault	*130*
	E. 13	**E. 13**	Internal circuit fault	*131*

4.4 Causes and corrective actions

(1) Error message

A message regarding operational troubles is displayed. The converter continues its operation.

Operation Panel Indication	HOLD	HOLd
Name	Operation panel lock	
Description	Operation lock is set. Operation other than STOP RESET is invalid. *(Refer to page 86)*	
Checkpoint	————	
Corrective action	Press MODE for 2s to release the lock.	

Operation Panel Indication	Er1	Er 1
Name	Parameter write error	
Description	• When you attempted to make parameter setting when *Pr. 77 Parameter write selection* has been set to disable parameter write. • When the PU and the converter cannot make normal communication. • When you attempted to set a parameter, of which setting cannot be changed during the converter operation.	
Checkpoint	• Check if parameter writing is attempted while *Pr. 77 Parameter write selection* = "1." • Check for a connection failure between the PU and the converter. • Check that the converter is not operating.	
Corrective action	• Perform parameter writing by setting *Pr. 77 Parameter write selection* = "2." • Check the connection of the PU and the converter. • After stopping the operation, make parameter setting.	

Operation Panel Indication	rE1	rE 1
Name	Parameter read error	
Description	When a failure occurs at the operation panel side EEPROM while reading copied parameters.	
Checkpoint	————	
Corrective action	• Perform parameter copy again. *(Refer to page 118)* • Failure of the operation panel (FR-DU07-CNV) might be the cause. Please contact your sales representative.	

Operation Panel Indication	rE2	rE2
Name	Parameter write error	
Description	When a failure occurs at the operation panel side EEPROM while writing copied parameters.	
Checkpoint	Check if FWD or REV LED on the operation panel (FR-DU07-CNV) is lit or flickering.	
Corrective action	Failure of the operation panel (FR-DU07-CNV) might be the cause. Please contact your sales representative.	

Operation Panel Indication	rE3	rE3
Name	Parameter verification error	
Description	• When the data in the converter are different from the data in the operation panel. • When a failure occurs at the operation panel side EEPROM during parameter verification.	
Checkpoint	Check the parameter setting of the source converter against the setting of the destination converter.	
Corrective action	• Continue the verification by pressing SET. Perform parameter verification again. *(Refer to page 119)* • Failure of the operation panel (FR-DU07-CNV) might be the cause. Please contact your sales representative.	

Operation Panel Indication	rE4	rE4
Name	Model error	
Description	• Parameter write or parameter verification of the parameter copy function is performed to an invalid model. • When writing of copied parameters is attempted after reading of copied parameters is interrupted	
Checkpoint	• Check that the verifying converter is the same model. • Check that the reading of copied parameter is not interrupted by switching OFF the power or by disconnecting the operation panel. • Check if parameter copy writing is attempted while *Pr. 77 Parameter write selection* = "1."	
Corrective action	• Perform parameter copy and parameter verification to the same model (FR-HC2 series). • Read the copied parameter again. • Perform parameter copy writing by setting *Pr. 77 Parameter write selection* = "2."	

Operation Panel Indication	Err.	Err.
Description	• When RES signal is ON. • When the PU and the converter cannot make normal communication. (Contact faults of the connector) • This error may occur when the voltage at the input side of the converter drops. • When using a separate power source for the control circuit power (R1/L11, S1/L21) from the main circuit power (R/L1, S/L2, T/L3), this error may appear at turning ON of the main circuit. It is not a fault.	
Corrective action	• Turn OFF the RES signal. • Check the connection between the PU and the converter. • Check the voltage on the input side of the converter.	

(2) Warning

When a warning occurs, The converter continues its operation.

Operation Panel Indication	OL	OL	FR-PU07	OL
Name	Overload signal detection			
Description	Appears when the current limit function of the converter activates.			
Checkpoint	• Check if the acceleration/deceleration time of the inverter is too short. • Check that the load is not too heavy. • Are there any failure in peripheral devices? • Check that the *Pr. 22 Current limit level* setting is appropriate. *(Refer to page 75)*			
Corrective action	• Set the acceleration/deceleration time of the inverter longer. • Reduce the load weight. • Check that the peripheral devices are operating properly. • Current limit level of the output current can be set with *Pr. 22Current limit level*. (Initial setting is 150%.) Set the current limit level higher with *Pr. 22 Current limit level*.			

Operation Panel Indication	PS	PS	FR-PU07	PS
Name	PU stop			
Description	Stop with STOP RESET of the PU is set in *Pr. 75 Reset selection/disconnected PU detection/PU stop selection*. (*For Pr. 75, refer to page 88*.)			
Checkpoint	Check for a stop made by pressing STOP RESET of the operation panel.			
Corrective action	Turn the converter stop signal (SOF) ON to stop the converter operation, and press PSCLR to release the PU stop.			

Operation Panel Indication	TH	TH	FR-PU07	TH
Name	Electronic thermal relay pre-alarm			
Description	Appears if the cumulative value of the electronic thermal relay reaches or exceeds 85% of the preset level. If it reaches 100% of the preset level, converter overload trip (E. THT) occurs. THP signal can be simultaneously output with the [TH] display. For the terminal used for THP signal, set "8 (positive logic)" or "108 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*. (*Refer to page 74)*			
Checkpoint	Check for large load or sudden acceleration.			
Corrective action	Reduce the load and frequency of operation.			

Operation Panel Indication	MT	MT	FR-PU07	MT
Name	Maintenance signal output			
Description	Indicates that the cumulative energization time of the converter has reached a given time. When the setting of *Pr. 35 Maintenance timer alarm output set time* is the initial setting (*Pr. 35* = "9999"), this warning does not occur.			
Checkpoint	Check that the *Pr. 34 Maintenance timer* setting is larger than *Pr. 35 Maintenance timer alarm output set time* setting. *(Refer to page 78)*			
Corrective action	Setting "0" to *Pr. 34 Maintenance timer* erases the signal.			

Operation Panel Indication	CP	CP	FR-PU07	CP
Name	Parameter copy			
Description	Appears when parameters are copied between models with capacities of 55K or lower and 75K or higher.			
Check point	Resetting of *Pr. 50, Pr. 51, Pr. 52, Pr. 53, Pr. 54, Pr. 55, Pr. 56* and *Pr. 57* is necessary.			
Corrective action	Set the initial value in *Pr. 989 Parameter copy alarm release*.			

Operation Panel Indication	SL	SL	FR-PU07	SL
Name	Power supply not detected			
Description	Appears when the power supply detection ends incompletely at a power failure. Appears at the power ON of the control circuit when using separate power sources for the control circuit power source and for the main circuit power source. It is not a fault.			
Checkpoint	Check the power source and the wiring. Check the wiring for power source detection.			
Corrective action	Perform wiring correctly.			

(3) Alarm

When an alarm occurs, the converter continues its operation. You can also output an alarm signal by making parameter setting.

(Set "98" in any of *Pr. 11 to Pr. 16 (output terminal function selection). Refer to page 74*)

Operation Panel Indication	FN	FN	FR-PU07	FN
Name	Fan alarm			
Description	FN appears on the operation panel when the cooling fan of the converter trips, when its speed drops, or when it does not operate as commanded by the *Pr. 36 Cooling fan operation selection*.			
Checkpoint	Check the cooling fan for a failure.			
Corrective action	Failure of the cooling fan might be the cause. Please contact your sales representative.			

(4) Fault

When a fault occurs, the converter trips and a fault signal is output. Output of the connected inverter is also shut off.

Operation Panel Indication	E.OC2	E.OC2	FR-PU07	Stedy Spd OC
Name	Overcurrent trip			
Description	Stops the converter operation when the input current exceeds the specified level during the converter operation.			
Checkpoint	• Check for sudden load change. • Check for output short-circuit. • Check that the wiring is performed correctly. • Check that any power supply failure did not occur.			
Corrective action	• Keep the load stable. • Check the wiring to make sure that output short circuit does not occur. • Check the wiring. • Check the power supply.			

Operation Panel Indication	E.OV2	E.Ov2	FR-PU07	Stedy Spd OV
Name	Overvoltage trip			
Description	If the converter's internal main circuit DC voltage reaches or exceeds the specified value, the protective circuit is activated to stop the converter operation.The circuit may also be activated by a surge voltage produced in the power supply system.			
Checkpoint	• Check for sudden load change and excessive regeneration. • Check that any power supply failure did not occur.			
Corrective action	• Keep the load stable. • Check the power supply.			

Operation Panel Indication	E.THT	E.THT	FR-PU07	Inv. Overload
Name	Overload trip (electronic thermal relay function) *1			
Description	For the protection of transistor, electronic thermal relay activates in inverse-time characteristics against the converter input to stop the converter operation.			
Checkpoint	• Check the motor for the use under overload. • Check if the inverter, which exceeds the converter capacity, is being used.			
Corrective action	• Reduce the load. • Reconsider the choices of the inverter and the converter.			

*1 Resetting the converter initializes the cumulative value of the internal thermal relay.

Operation Panel Indication	E.FIN	E.FIn	FR-PU07	H/Sink O/Temp
Name	Fin overheat			
Description	If the heatsink overheats, the temperature sensor is activated and the output of the converter operation stops. The FIN signal can be output when the temperature becomes approximately 85% of the heatsink overheat protection operation temperature. For the terminal used for FIN signal, set "10 (positive logic)" or "110 (negative logic)" to any of *Pr. 11 to Pr. 16 (output terminal function selection)*. (*Refer to page 74)*			
Checkpoint	• Check for too high surrounding air temperature. • Check for heatsink clogging. • Check that the cooling fan is not stopped. (Check that FN is not displayed on the operation panel.)			
Corrective action	• Set the surrounding air temperature to within the specifications. • Clean the heatsink. • Replace the cooling fan.			

Operation Panel Indication	E.IPF	E.IPF	FR-PU07	Inst. Pwr. Loss
Name	Instantaneous power failure			
Description	When a power failure occurs (or when power input to the converter is shut off), the instantaneous power failure protection function activates to stop the converter operation and prevent the control circuit from malfunctioning. If a power failure persists for 100ms or longer, the alarm warning output is not provided, and the converter (inverter) restarts when the start signal is ON upon power restoration. In some operating status (load magnitude, acceleration/deceleration time setting of the inverter, etc.), overcurrent or other protection may be activated upon power restoration. The IPF signal is output when a power failure is detected. (*Refer to page 74)*			
Checkpoint	Identify the cause of instantaneous power failure occurrence.			
Corrective action	• Recover the instantaneous power failure. • Prepare a backup power supply for instantaneous power failure. • Set the function of automatic restart after instantaneous power failure *(Pr. 57)*. (*Refer to page 85)*			

Operation Panel Indication	E.UVT	E.UVT	FR-PU07	Under Voltage
Name	Undervoltage			
Description	If the power supply voltage of the converter decreases, the control circuit will not perform its normal functions. The converter operation is stopped when the power supply voltage decreases to about 150VAC (about 300VAC for the 400V class) or lower.			
Checkpoint	Check for start of large-capacity motor.			
Corrective action	Check the power supply system equipment such as the power supply. If the problem still persists after taking the above measure, please contact your sales representative.			

Operation Panel Indication	E.ILF	E.ILF	FR-PU07	Input phase loss
Name	Input phase loss			
Description	Converter trips when one phase of the three phase power input is lost.			
Checkpoint	Check for a break in the cable for the three-phase power supply input.			
Corrective action	• Wire the cables properly. • Repair a break portion in the cable.			

Operation Panel Indication	E.OHT	E.OHT	FR-PU07	OH Fault
Name	External thermal relay operation			
Description	If an overheat protection device such as a thermostat activates, the converter operation is stopped. This function is available when "4" (OH signal) is set to any of *Pr. 3 to Pr. 7* (input terminal function selection). This protective function is not available in the initial status (OH signal is not assigned).			
Checkpoint	• Check for the overheat of the overheat protection peripheral devices such as a thermostat. • Check that the value "4" (OH signal) is set correctly to any of *Pr. 3 to Pr. 7* (input terminal function selection).			
Corrective action	• Check the wiring. • Even if the thermostat restarts automatically, the converter does not restart unless it is reset.			

Operation Panel Indication	E. 2	E. 2	FR-PU07	Fault 2
Name	HC2 dedicated board disconnection			
Description	Stops the converter operation when contact fault between the converter and the connecting part of the HC2 dedicated board occurs.			
Checkpoint	• Check that HC2 dedicated board is connected to the connector securely. • Check for excess electrical noises around the converter.			
Corrective action	• Connect the HC2 dedicated board securely. • Take measures against noises if there are devices producing excess electrical noises around the converter. If the problem still persists after taking the above measure, please contact your sales representative.			

Operation panel indication	E. 3	E. 3	FR-PU07	Fault 3
Name	Option fault			
Description	Stops the converter operation if a contact fault or the like of the connector between the converter and communication option occurs. Appears when the switch for the manufacturer setting of the plug-in option is changed.			
Check point	• Check that the plug-in option unit is plugged into the connector securely. • Check for excess electrical noises around the converter. • Check the switch position for the manufacturer setting of the plug-in option.			
Corrective action	• Connect the plug-in option securely. • Take measures against noises if there are devices producing excess electrical noises around the converter. If the problem still persists after taking the above measure, please contact your sales representative. • Return the switch position for the manufacturer setting of the plug-in option to the initial status. (*Refer to the instruction manual of each option*)			

Operation panel indication	E.OP3	E.OP3	FR-PU07	Option slot alarm 3
Name	Communication option fault			
Description	Stops the converter operation when a communication line fault occurs in the communication option.			
Check point	• Check for a wrong option function setting and operation. • Check that the plug-in option unit is plugged into the connector securely. • Check for a break in the communication cable. • Check that the terminating resistor is fitted properly.			
Corrective action	• Check the option function setting, etc. • Connect the plug-in option securely. • Check the connection of communication cable. • Connect the terminating resistor correctly.			

Operation Panel Indication	E.PE	E. PE	FR-PU07	Corrupt Memry
Name	Parameter storage device fault (control circuit board)			
Description	Stops the converter operation if a fault occurred in the parameter stored. (EEPROM fault)			
Checkpoint	Check for too many number of parameter write times.			
Corrective action	Please contact your sales representative. When performing parameter write frequently for communication purposes, set "1" to *Pr. 342* to enable RAM write. Note that powering OFF returns the converter to the status before RAM write.			

Operation Panel Indication	E.PE2	E.PE2	FR-PU07	PR storage alarm
Name	Parameter storage device fault (main circuit board)			
Description	Stops the converter operation if a fault occurred in the parameter stored. (EEPROM fault)			
Checkpoint	————————			
Corrective action	Please contact your sales representative.			

Operation Panel Indication	E.PUE	E.PUE	FR-PU07	PU Leave Out
Name	PU disconnection			
Description	• This function stops the converter operation if communication between the converter and PU is suspended, e.g. the parameter unit is disconnected, when "2", "3", "16" or "17" was set in *Pr. 75 Reset selection/ disconnected PU detection/PU stop selection*. This protective function is not available in the initial setting (*Pr. 75* = "14").			
Checkpoint	• Check that no loose point exists in the installation of FR-DU07-CNV or the parameter unit (FR-PU07). • Check the *Pr. 75* setting.			
Corrective action	Install FR-DU07-CNV or the parameter unit (FR-PU07) securely.			

Operation Panel Indication	E.RET	E.rET	FR-PU07	Retry No Over
Name	Retry count excess			
Description	If operation cannot be resumed properly within the number of retries set, this function stops the converter operation. This function is available only when *Pr. 67 Number of retries at fault occurrence* is set. When the initial value (*Pr. 67* = "0") is set, this protective function is not available.			
Checkpoint	Find the cause of the fault occurrence.			
Corrective action	Eliminate the cause of the fault preceding this fault indication.			

Operation Panel Indication	E. 6	E. 6	FR-PU07	Fault 6
	E. 7	E. 7		Fault 7
	CPU	E.CPU		CPU fault
Name	CPU fault			
Description	Stops the converter operation if the communication fault of the built-in CPU occurs.			
Checkpoint	Check for devices producing excess electrical noises around the converter.			
Corrective action	• Take measures against noises if there are devices producing excess electrical noises around the converter. • Please contact your sales representative.			

Operation Panel Indication	E.8	E. 8	FR-PU07	Fault 8
Name	Input power supply fault 1			
Description	• When a fault is detected in the power supply frequency. • When the phase detection cannot be performed for the normal power supply. • When an overvoltage occurs during power failure or at an input phase loss. • When the power supply amplitude changes suddenly. When any of the above occurs, it is regarded as a power supply fault, and the converter operation and the inverter output are stopped.			
Checkpoint	Check the power source and the wiring.			
Corrective action	Perform wiring correctly.			

Operation Panel Indication	E.9	E. 9	FR-PU07	Fault 9
Name	Input power supply fault 2			
Description	When the converter operation is stopped continuously due to the fluctuation of input voltage or input current, it is regarded as a power supply fault, and the converter operation and the inverter output are stopped.			
Checkpoint	Check the power source and the wiring.			
Corrective action	• Perform wiring correctly. • Adjust *Pr. 80 Voltage control proportional gain Pr. 81 Voltage control integral gain Pr. 82 Current control proportional gain , and Pr. 83 Current control integral gain*.			

Operation Panel Indication	E.CTE	E.CTE	FR-PU07	E.CTE
Name	Operation panel power supply short circuit, RS-485 terminal power supply short circuit			
Description	When the operation panel power supply (PU connector) is shorted, this function shuts OFF the power output and stops the converter operation. At this time, the operation panel (parameter unit) cannot be used and RS-485 communication from the PU connector cannot be made. When the power supply for the RS-485 terminals are shorted, this function shuts OFF the power output. To reset, enter RES signal or switch power OFF, then ON again.			
Checkpoint	• Check for a short circuit in the PU connector cable. • Check if the RS-485 terminals are used.			
Corrective action	• Check the PU and cable. • The RS-485 terminals cannot be used.			

Operation Panel Indication	E.P24	E.P24	FR-PU07	E.P24
Name	24VDC power output short circuit			
Description	When the 24VDC power output from the PC terminal is shorted, this function shuts OFF the power output. At this time, all external contact inputs switch OFF. The converter cannot be reset by entering the RES signal. To reset, use the operation panel or switch power OFF, then ON again.			
Checkpoint	• Check for a short circuit in the PC terminal output.			
Corrective action	• Repair the short-circuited portion.			

Operation Panel Indication	E.CDO	E.CdO	FR-PU07	OC detect level
Name	Input current detection value exceeded			
Description	Stops the converter operation when the input current exceeds *Pr. 25 Input current detection level* setting. This function is available when "1" is set to *Pr. 28 Input current detection operation selection*. When the initial value (*Pr. 28* = "0") is set, this protective function is not available.			
Checkpoint	Check the settings of *Pr. 25Input current detection level , Pr. 26 Input current detection signal delay time, Pr. 27 Input current detection signal retention time, Pr. 28 Input current detection operation selection* (*Refer to page 76)*			

Operation Panel Indication	E.IOH	E.1 OH	FR-PU07	Inrush overheat
Name	Inrush current limit circuit fault			
Description	Stops the converter operation when the inrush current limit contactor does not turn ON, a thermostat of the limit resistor activates, or the filter capacitor alarm detector activates. (Filter capacitor alarm detector is only available for 560K.) Inrush current limit circuit is faulty. When the terminal PC and SD are shorted, the ROH signal turns OFF and the converter operation stops.			
Checkpoint	• Check that ROH1 and ROH2 of the outside box are respectively connected to ROH and SD of the converter. • Check that the inrush current limit circuit contactor and buffer circuit are not damaged. • Check that frequent power ON/OFF is not repeated. • Check that the output terminal of the filter capacitor alarm detector is connected to the terminal ROH. • Check that thermostats of the limit resistor are connected to terminal ROH. • Check that terminals PC and SD are not shorted.			
Corrective action	• Connect ROH1 and ROH2 of the outside box to ROH and SD of the converter respectively. • Check the wiring of the output terminal of the filter capacitor alarm detector and the terminal ROH. • Configure a circuit where frequent power ON/OFF is not repeated. • Check the wiring between the thermostats of the limit resistor and terminal ROH. • Check the wiring between terminals PC and SD. If the problem still persists after taking the above measure, please contact your sales representative.			

Operation Panel Indication	E.13	E. 13	FR-PU07	Fault 13
Name	Internal circuit fault			
Description	Stops the converter operation when an internal circuit fault occurs.			
Corrective action	Please contact your sales representative.			

NOTE

- **If faults other than the above appear, contact your sales representative.**

4.5 Correspondences between digital and actual characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel:

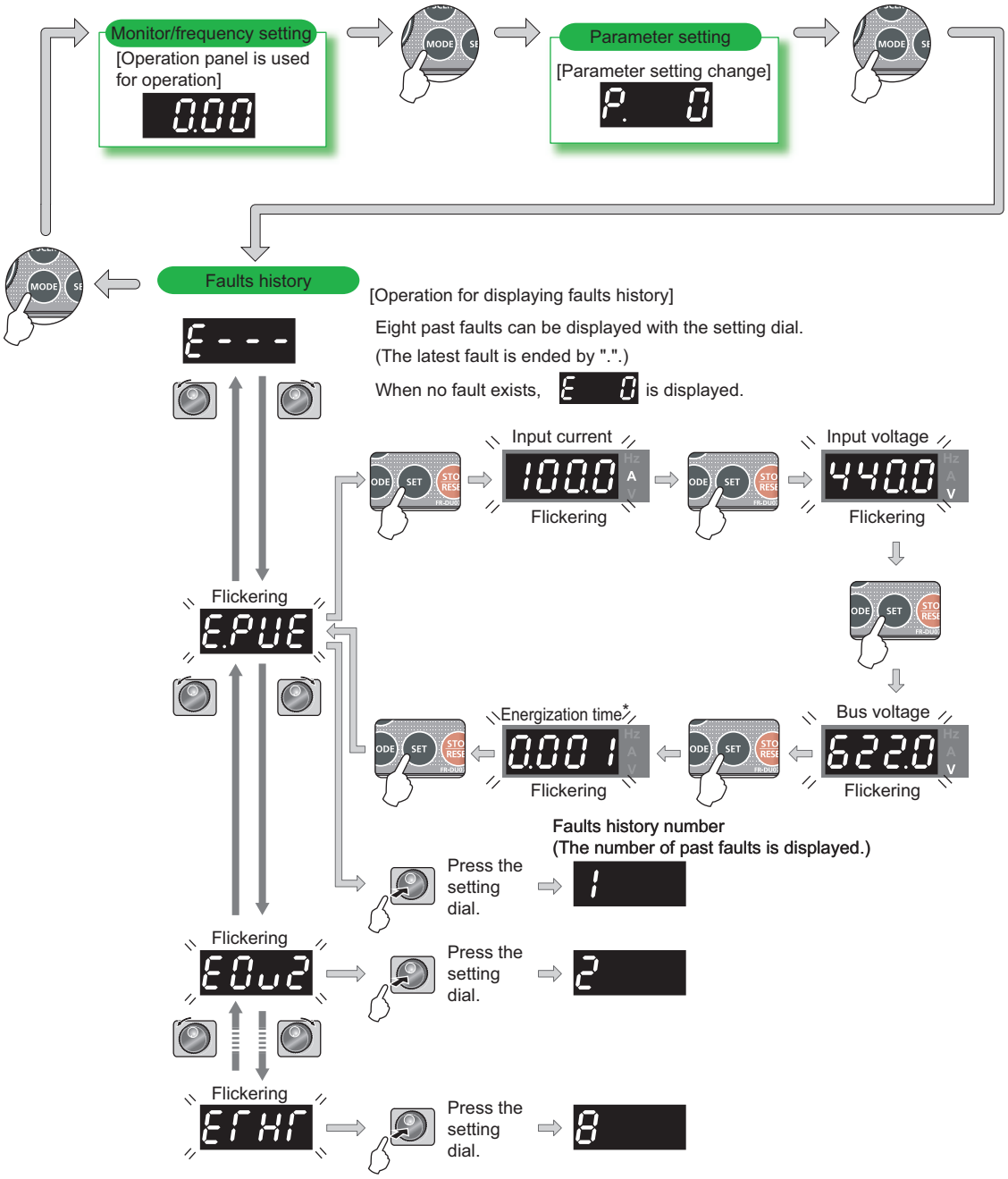
Actual	Digital
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Actual	Digital
A	A
B	b
C	C
D	d
E	E
F	F
G	G
H	H
I	I
J	J
L	L

Actual	Digital
M	M
N	n
O	O
o	o
P	P
S	S
T	r
U	U
V	v
r	r
-	-

4.6 Check and clear of the faults history

(1) Check and clear of the faults history

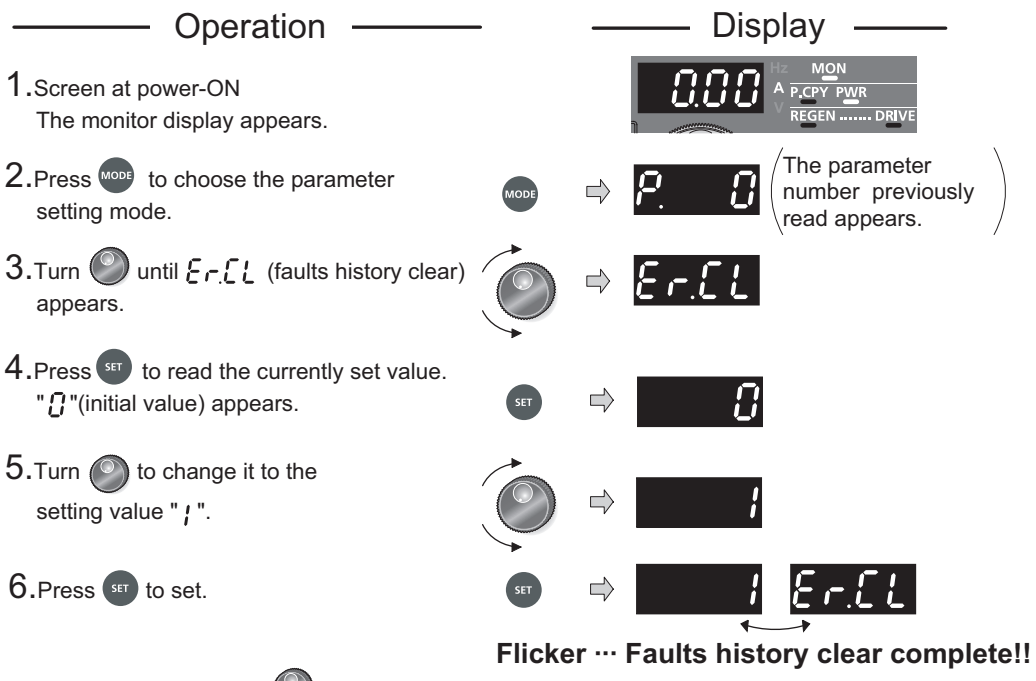


* The cumulative energization time is accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.
When using the operation panel (FR-DU07-CNV), the time is displayed up to 65.53 (65530h) by regarding 1h = 0.001, and thereafter, it is added up from 0.

(2) Clearing procedure

POINT

- Set *Er.CL Fault history clear* = "1" to clear the faults history.



· Press to read another parameter.

· Press SET to show the setting again.

· Press SET twice to show the next parameter.

4.7 Check first when you have a trouble

Trouble	Checkpoint
Converter does not operate properly.	Check the connection. ● Check if the wiring is performed correctly. ● Check if appropriate power supply voltage is applied. ● Check if the phase sequence is correct. ↳ If the phase sequence is correct, check for the short circuit across terminals SOF and SD and across terminals RES and SD.
POWER lamp is unlit.	Check the connection. ● Check if the connection is performed correctly. ● Check if the main circuit terminals R/L1, S/L2 and T/L3 are wired correctly. ● Check for any damage to the inrush current limit resistor
Charge lamp is unlit.	Check the connection. ● Check if the connection is performed correctly. ● Check if the main circuit terminals R4/L14, S4/L24 and T4/L34 are wired correctly.
Reactor heats up abnormally.	Check the connection. ● Check if the order of the reactor 1 and the reactor 2 is correct.
Unable to run the inverter.	Check the setting. ● Check if the parameter setting of the inverter is correct. (Parameter setting method differs by the inviter series. For the parameter setting method, refer to the Inverter Instruction Manual.)
Abnormal acoustic noise is generated from the reactor.	Check if the phase sequence is correct.
Breaker trips.	Check the connection. ● Check if the wiring is performed correctly. ● Check if appropriate power supply voltage is applied. ● Check if the phase sequence is correct. Check the above points, identify the cause of the trip and remove it before turning ON the breaker power .

5 MAINTENANCE AND INSPECTION

This chapter provides the "MAINTENANCE AND INSPECTION" of this product.
Always read the instructions before using the equipment.

5.1 Inspection items..... 136
5.2 Measurement of main circuit voltages, currents and powers .. 143

The converter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

●Precautions for maintenance and inspection

For some short time after the power is switched OFF, a high voltage remains in the smoothing capacitor. When accessing the converter for an inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the converter is not more than 30VDC using a tester, etc.

⚠ CAUTION

⚠ Reactor 1 and reactor 2 are extremely hot. Take caution not to get burned.

5.1 Inspection items

5.1.1 Daily inspection

Basically, check for the following faults during operation.

1) Improper installation environment
2) Cooling system fault
3) Abnormal vibration, abnormal noise
4) Abnormal overheat, discoloration

5.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.
Consult us for periodic inspection.

1) Check for cooling system fault.....Clean the air filter, etc.
2) Tightening check and retightening.....The screws and bolts may become loose due to vibration, temperature changes, etc. Check and tighten them.
   Tighten them according to the specified tightening torque. *(Refer to page 46)*
3) Check the conductors and insulating materials for corrosion and damage.
4) Measure insulation resistance.
5) Check and change the cooling fan and relay.

5.1.3 Daily and periodic inspection list

Area of Inspection	Inspection Item		Description	Interval		Corrective Action at Alarm Occurrence	Customer's Check
				Daily	Periodic *2		
General	Surrounding environment		Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist, etc.	○		Improve the environment.	
	Overall unit		Check for unusual vibration and noise.	○		Check alarm location and retighten.	
	Power supply voltage		Check that the main circuit voltage and control circuit voltage are normal. *1	○		Inspect the power supply.	
Main Circuit	General		(1) Check with megger (across main circuit terminals and earth (ground) terminal).		○	Contact the manufacturer.	
			(2) Check for loose screws and bolts.		○	Retighten.	
			(3) Check for overheat traces on the parts.		○	Contact the manufacturer.	
			(4) Check for stain.		○	Clean.	
	Conductors, cables		(1) Check conductors for distortion.		○	Contact the manufacturer.	
			(2) Check cable sheaths for breakage and deterioration (crack, discoloration, etc.).		○	Contact the manufacturer.	
	Transistor / Reactor		Check for unusual odor and abnormal increase of whining sound.	○		Stop the device and contact the manufacturer.	
	Terminal block		Check for a damage.		○	Stop the device and contact the manufacturer.	
	Smoothing aluminum electrolytic capacitor		(1) Check for liquid leakage.		○	Contact the manufacturer.	
			(2) Check for safety valve projection and bulge.		○	Contact the manufacturer.	
			(3) Visual check		○		
	Relay / Contactor		Check that the operation is normal and no chatter is heard.		○	Contact the manufacturer.	
Control Circuit Protective circuit	Operation check		Check that no fault is found in protective and display circuits in a sequence protective operation test.		○	Contact the manufacturer.	
	Parts check	Overall	(1) Check for unusual odor and discoloration.		○	Stop the device and contact the manufacturer.	
			(2) Check for serious rust development.		○	Contact the manufacturer.	
		Aluminum electrolytic capacitor	(1) Check for liquid leakage in a capacitor and deformation trace.		○	Contact the manufacturer.	
			(2) Visual check		○		
Cooling system	Cooling fan		(1) Check for unusual vibration and noise.	○		Replace the cooling fan.	
			(2) Check for loose screws and bolts.		○	Retighten.	
			(3) Check for stain.		○	Clean.	
	Heatsink		(1) Check for clogging.		○	Clean.	
			(2) Check for stain.		○	Clean.	
	Air filter, etc.		(1) Check for clogging.		○	Clean or replace.	
			(2) Check for stain.		○	Clean or replace.	
Display	Indication		(1) Check that display is normal.	○		Contact the manufacturer.	
			(2) Check for stain.		○	Clean.	
	Meter		Check that reading is normal.	○		Stop the device and contact the manufacturer.	

*1 It is recommended to install a device to monitor voltage for checking the power supply voltage to the converter.

*2 One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. Consult us for periodic inspection.

5.1.4 Checking the converter module

<Preparation>

(1) Disconnect the external power supply cables (R4/L14, S4/L24, T4/L34, P/+, N/-)
(2) Prepare a tester. (Use 100Ω range.)

<Checking method>

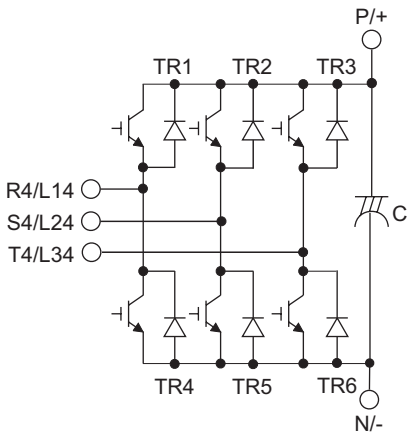
Change the polarity of the tester alternately at the converter terminals R4/L14, S4/L24, T4/L34, P/+, N/- and check the electric continuity.

NOTE

- **Before measurement, check that the smoothing capacitor is discharged.**
- **At the time of electric discontinuity, the measured value is almost ∞. When there is an instantaneous electric continuity, due to the smoothing capacitor, the tester may not indicate ∞. At the time of electric continuity, the measured value is several Ω to several tens of Ω. If all measured values are almost the same, although these values are not constant depending on the module type and tester type, the modules are without fault.**

(3) <Module device numbers and terminals to be checked>

Converter module	Tester Polarity		Measured Value
	⊕	⊖	
TR1	R4/L14	P	Discontinuity
	P	R4/L14	Continuity
TR2	S4/L24	P	Discontinuity
	P	S4/L24	Continuity
TR3	T4/L34	P	Discontinuity
	P	T4/L34	Continuity
TR4	R4/L14	N	Continuity
	N	R4/L14	Discontinuity
TR5	S4/L24	N	Continuity
	N	S4/L24	Discontinuity
TR6	T4/L34	N	Continuity
	N	T4/L34	Discontinuity



(Assumes the use of an analog meter.)

5.1.5 Cleaning

Always run the converter in a clean status.
When cleaning the converter, gently wipe dirty areas with a soft cloth immersed in neutral detergent.

NOTE

Do not use solvent, such as acetone, benzene, toluene and alcohol, as they will cause the surface paint of the converter to peel off.
The display, etc. of the operation panel and parameter unit are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

5.1.6 Replacement of parts

The converter consists of many electronic parts such as semiconductor devices.
The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the converter. For preventive maintenance, the parts must be replaced periodically.

Estimated lifespan interval of the converter parts is shown in the below table.

Part Name	Estimated lifespan *1	Description
Cooling fan	10 years	Replace (as required)
Main circuit smoothing capacitor	10 years *2	Replace (as required)
On-board smoothing capacitor	10 years	Replace the board (as required)
Relays	———	As required
Fuse inside the converter (280K or higher)	10 years	Replace (as required)

*1 Estimated lifespan for when the yearly average surrounding air temperature is 40°C (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)

*2 Input current: 80% of the converter rated current

REMARKS

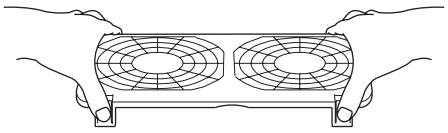
For parts replacement, contact the nearest Mitsubishi FA center.

(1) Cooling fan

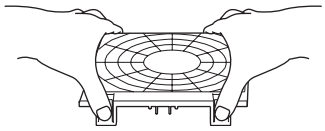
The replacement interval of the cooling fan used for cooling the parts generating heat such as the main circuit semiconductor is greatly affected by the surrounding air temperature. When unusual noise and/or vibration are noticed during inspection, the cooling fan must be replaced immediately.

• Removal (FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K)

1) Push the hooks from above and remove the fan cover.

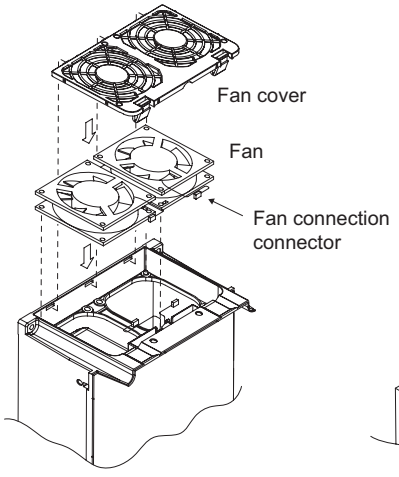


FR-HC2-7.5K, 15K

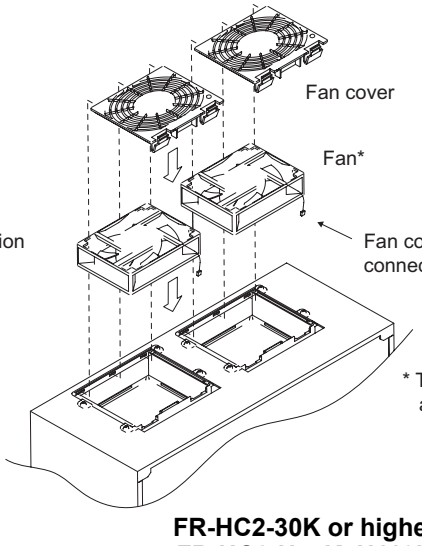


FR-HC2-30K or higher
FR-HC2-H75K, H110K

2) Disconnect the fan connectors.
3) Remove the fan.



FR-HC2-7.5K, 15K
(Example for FR-HC2-7.5K)

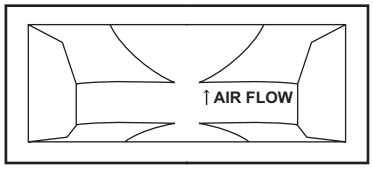


* The number of cooling fans differs according to the converter capacity.

FR-HC2-30K or higher
FR-HC2-H75K, H110K
(Example for FR-HC2-55K)

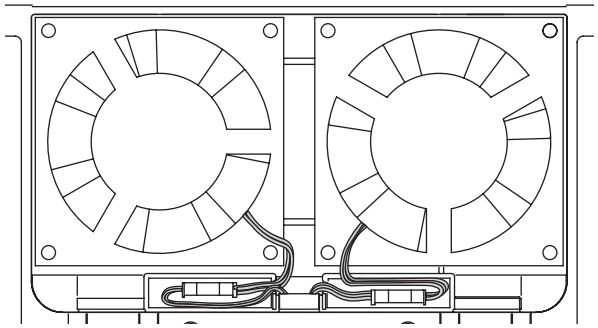
• Reinstallation (FR-HC2-7.5K to 75K, FR-HC2-H75K, H110K)

1)After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.

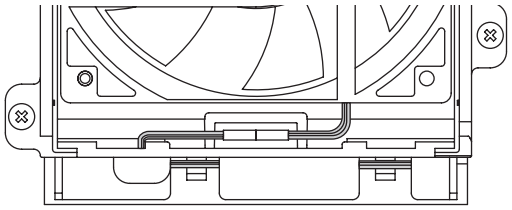


<Fan side face>

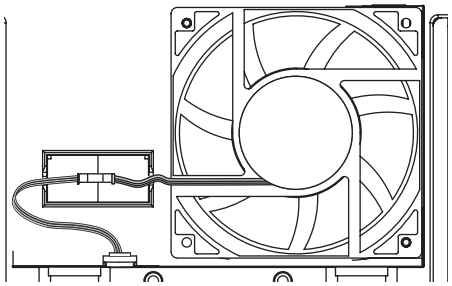
2)Reconnect the fan connectors.



FR-HC2-7.5K

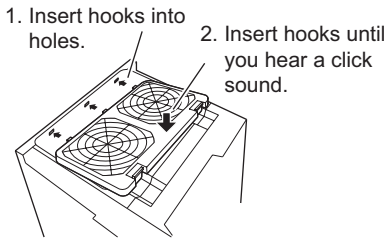


FR-HC2-30K or higher
FR-HC2-H75K, H110K

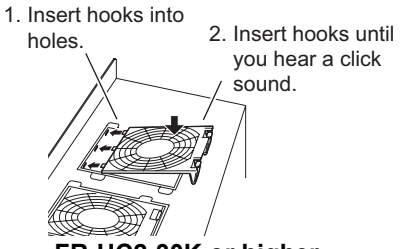


FR-HC2-15K

3) Reinstall the fan cover.



FR-HC2-7.5K, 15K
(Example for FR-HC2-7.5K)



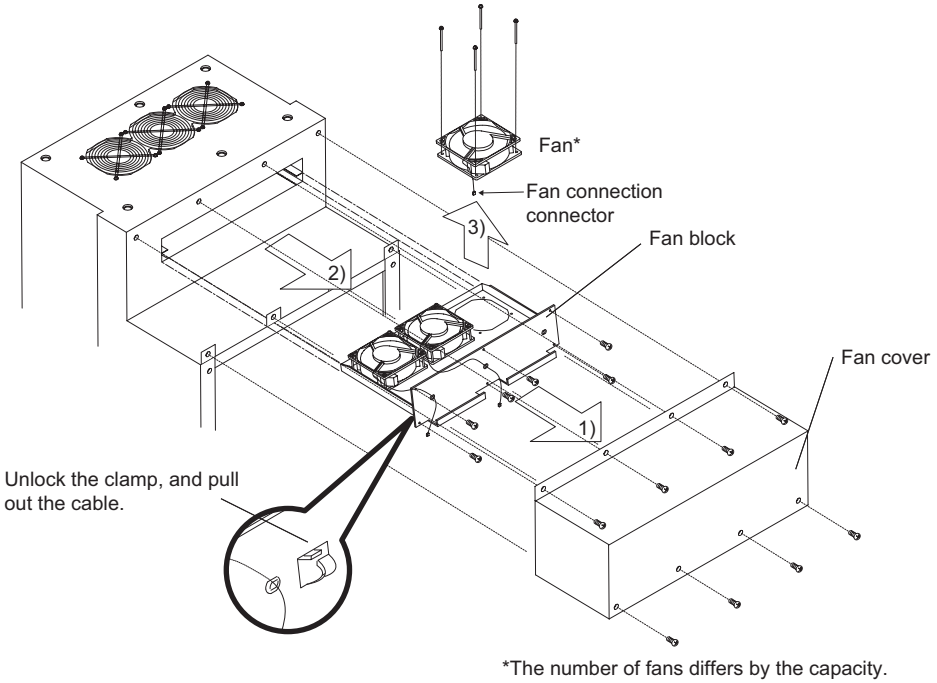
FR-HC2-30K or higher
FR-HC2-H75K, H110K
(Example for FR-HC2-55K)

NOTE

- **Installing the fan in the opposite of air flow direction can cause the converter life to be shorter.**
- **Prevent the cable from being caught when installing a fan.**
- **Switch the power OFF before replacing fans. Since the converter circuits are charged with voltage even after power OFF, replace fans only when the converter cover is on the converter to prevent an electric shock accident.**

●Removal (FR-HC2-H280K or higher)

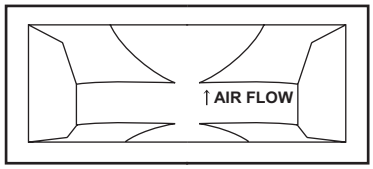
1) Remove the fan cover.
2) Remove the fan connector, then remove the fan block.
3) Remove the fan. (Make sure to remove the fan cable from the clamp of the fan block beforehand.)



*The number of fans differs by the capacity.

●Reinstallation (FR-HC2-H280K or higher)

1) After confirming the orientation of the fan, reinstall the fan so that the "AIR FLOW" faces up.



2) Reinstall the fan by referring to the above figure.

NOTE

- **Installing the fan in the opposite direction of air flow can cause the converter life to be shorter.**
- **Prevent the cable from being caught when installing a fan.**
- **Switch the power OFF before replacing fans. Since the converter circuits are charged with voltage even after power OFF, replace fans only when the converter cover is on the converter to prevent an electric shock accident.**

(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the main circuit DC section, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Their characteristics are deteriorated by the adverse effects of ripple currents, etc. The replacement intervals greatly vary with the surrounding air temperature and operating conditions. When the converter is operated in air-conditioned, normal environment conditions, replace the capacitors about every 10 years.

When a certain period of time has elapsed, the capacitors will deteriorate more rapidly. Check the capacitors at least every year (less than six months if the life will be expired soon).

The appearance criteria for inspection are as follows:

1) Case: Check the side and bottom faces for expansion
2) Sealing plate: Check for remarkable warp and extreme crack.
3) Explosion-proof valve: Check for extreme valve expansion, and movement of the value.
4) Check for external crack, discoloration, liquid leakage, etc. Judge that the capacitor has reached its life when the measured capacitance of the capacitor reduced below 85% of the rating. Convenient tools that measure capacitor capacity are commercially available, and are recommended to be used.

(3) Relays

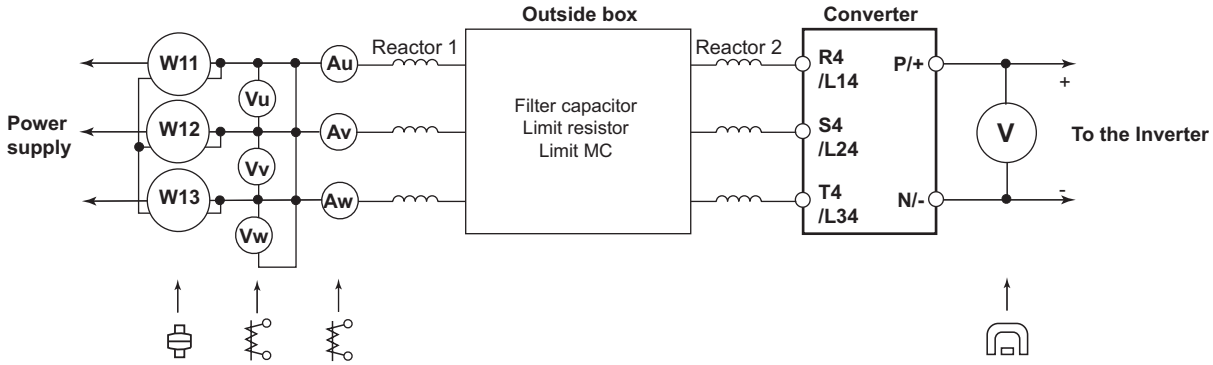
To prevent a contact fault, etc., relays must be replaced according to the cumulative number of switching times (switching life).

(4) Fuse inside the converter (280K or higher)

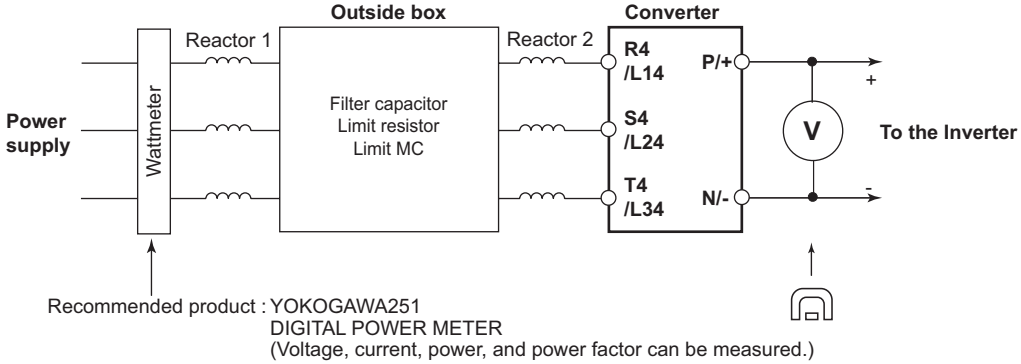
A fuse is used inside the converter. Surrounding air temperature and operating condition affect the life of fuses. When the converter is used in a normal air-conditioned environment, replace its fuse after about 10 years.

5.2 Measurement of main circuit voltages, currents and powers

- Measurement method of voltage and current at each section
  When instruments for commercial frequency are used for measurement, measure the following circuits with the instruments given below.
- When installing meters etc. on the output side of the converter
  When the converter-to-motor wiring length is long, especially in the 400V class, the meters may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.
- Voltage is output between the terminal P and N of the converter, and it can be measured using a moving-coil type meter (tester). The voltage changes by the power supply voltage, but it decreases when a load is applied.



[Examples of Measuring Points and Instruments]

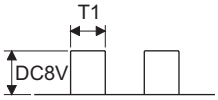


[Examples of Measuring Points and Instruments]

- Operation principle and application of electric meters

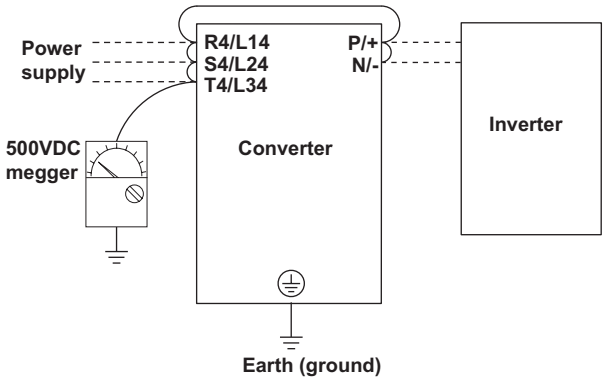
Type		Symbol	Operation Principle	Command	Applicable meter	Characteristic
Moving-coil type			Uses kinetic power generated between the magnetic field of a permanent magnet and the current that flows through the moving-coil.	DC (average value)	Voltmeter/ammeter/ resistance meter/ thermometer/flux meter/speed meter	High sensitivity and commonly used. Energy saving, small influence of magnetic field
Moving-iron meter			Uses kinetic power generated between the the moving-iron and the magnetic field of the current that flows though the fixed coil.	AC (effective value)	Voltmeter/ammeter	Strong structure and inexpensive, Large influence from external magnetic field, frequency, and waveform
Ammeter type	Air-core coil		Uses kinetic power generated between the currents that flow through two different coils.	AC/DC (effective value)	Wattmeter/ voltmeter/ammeter	Scale is divided equally when using a wattmeter. Large influence from external magnetic field, high energy consumption This can be used as a standard meter for AC and DC.

Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value)
Power supply voltage V_1	Across R and S Across S and T Across T and R	Moving-iron type AC voltmeter	Commercial power supply Within permissible AC voltage fluctuation *(Refer to page 146)*
Power supply side current I_1	R, S, T line current	Moving-iron type AC ammeter	
Power supply side power P_1	R, S, T and Across R and S Across S and T Across T and R	Electrodynamic type single-phase wattmeter	$P_1=W_{11}+W_{12}+W_{13}$ (3-wattmeter method)
Power supply side power factor Pf_1	Calculate after measuring power supply voltage, power supply side current and power supply side power. $Pf_1=\frac{P_1}{\sqrt{3}V_1\times I_1}\times 100\%$		
Converter output	Across P and N	Moving-coil type (such as tester)	Converter LED display is lit. $1.35\times V_1$ Maximum 380V (200V class) and 760V (400V class) during the regenerative driving
Indicator signal	Across FM(+) and SD	Moving-coil type (such as tester) (internal resistance 50kΩ or more)	Approximately 5VDC at maximum frequency (without indicator)  Pulse width T1: Adjust with *Pr. 900*
Input signal	RES, SOF, X1, X2, Across ROH(+) and SD		When open 20 to 30VDC ON voltage: 1V or less
Fault signal	Across A and C Across B and C	Moving-coil type (such as tester)	Electric continuity check [Normal] [Abnormal] Across A and C Discontinuity Continuity Across B and C Continuity Discontinuity

5.2.1 Insulation resistance test using megger

- For the converter, conduct the insulation resistance test on the main circuit only as shown below and do not perform the test on the control circuit. (Use a 500VDC megger.)



NOTE

- **Before performing the insulation resistance test on the external circuit, disconnect the cables from all terminals of the converter so that the test voltage is not applied to the converter.**
- **For the electric continuity test of the control circuit, use a tester (high resistance range) and do not use the megger or buzzer.**

5.2.2 Pressure test

Do not conduct a pressure test. Deterioration may occur.

6 SPECIFICATIONS

This chapter provides the "SPECIFICATIONS" of this product.
Always read the instructions before using the equipment.

6.1 Rated specifications 146
6.2 Common specifications 147
6.3 Outline dimensions..... 148

6.1 Rated specifications

●200V

Model name FR-HC2-□K	7.5	15	30	55	75
Applicable inverter capacity (kW)	7.5	15	30	55	75
Rated output capacity (kW) *1	10.7	19.8	38	71	92
Rated input voltage (V)	Three-phase 200V to 220V 50Hz/200V to 230V 60Hz*2				
Rated input current (A)	33	61	115	215	278
Overload current rating *3	150% 60s				
Permissible power supply voltage fluctuation	170V to 242V 50Hz 170V to 253V 60Hz				170V to 230V 50Hz/60Hz
Permissible power supply frequency fluctuation	±5%				
Input power factor	0.99 or more (when load ratio is 100%)				
Power supply capacity (kVA)	14	25	47	88	110
Protective structure of the converter *4	Enclosed type (IP20)*5		Open type (IP00)		
Cooling system	Forced air cooling				
Approximate mass (kg) *6	7	12	24	39	53

*1 DC output capacity when the input voltage is 200VAC.

*2 The permissible voltage imbalance ratio is 3% or less. (Imbalance ratio = (highest voltage between lines - average voltage between three lines) / average voltage between three lines × 100)

*3 The % value of the overload current rating indicates the ratio of the overload current to the converter's rated input current. For repeated duty, allow time for the converter and the inverter to return to or below the temperatures under 100% load.

*4 The protective structure is IP40 for FR-DU07-CNV (except the PU connector) and IP00 for the reactor and outside box regardless of their capacities.

*5 When the hook of the converter front cover is cut off for installation of the plug-in option, the protective structure changes to the open type (IP00).

*6 Mass of FR-HC2 alone.

●400V

Model name FR-HC2-H□K *1	75	110	280	560
Applicable inverter capacity (kW)	75	110	280	560
Rated output capacity (kW) *3	92	135	336	660
Rated input voltage (V) *4	Three-phase 380V to 460V 50Hz/60Hz*2			
Rated input current (A)	139	203	506	993
Overload current rating *5	150% 60s			
Permissible power supply voltage fluctuation	323V to 460V 50/60Hz			
Permissible power supply frequency fluctuation	±5%			
Input power factor	0.99 or more (when load ratio is 100%)			
Power supply capacity (kVA)	113	165	410	804
Protective structure of the converter *6	Open type (IP00)			
Cooling system	Forced air cooling			
Approximate mass (kg) *7	37	56	160	250

*1 Model name of the 400V class ends with H.

*2 The permissible voltage imbalance ratio is 3% or less. (Imbalance ratio = (highest voltage between lines - average voltage between three lines) / average voltage between three lines × 100)

*3 DC output capacity when the input voltage is 400VAC

*4 Change the stepdown transformer tap according to the input voltage. *(Refer to page 48)*

*5 The % value of the overload current rating indicates the ratio of the overload current to the converter's rated input current. For repeated duty, allow time for the converter and the inverter to return to or below the temperatures under 100% load.

*6 The protective structure is IP40 for FR-DU07-CNV (except the PU connector) and IP00 for the outside box (110K or lower) and the reactor regardless of their capacities.

*7 Mass of FR-HC2 alone.

6.2 Common specifications

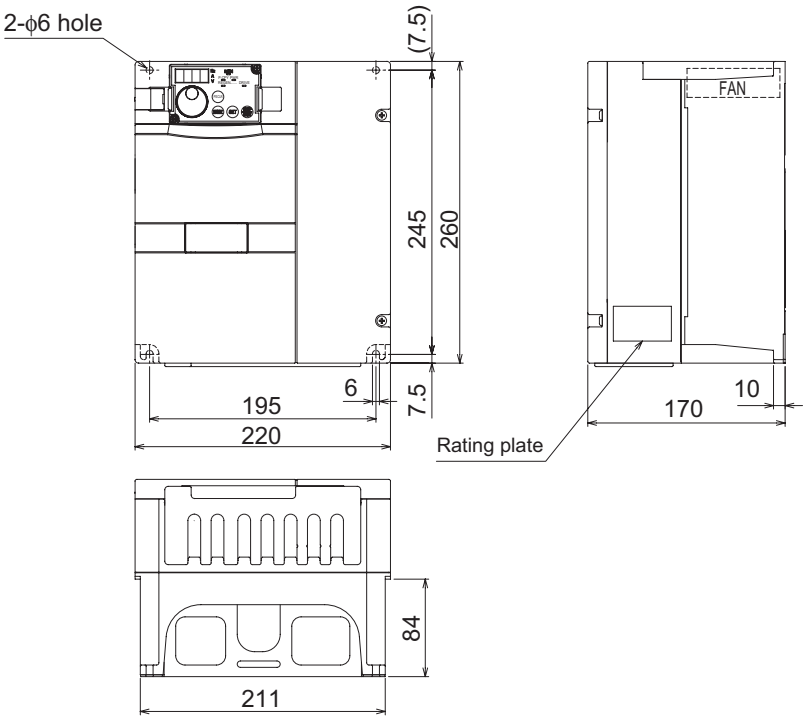
Control specification	**Control method**		PWM control
	Power supply frequency range		50Hz to 60Hz
	Current limit level		Current limit value selectable (0 to 220% variable)
Operation specification	**Input signal (Five terminal)**		The following signals can be assigned to *Pr. 3 to Pr. 7 (input terminal function selection)*: converter stop, monitor switching, converter reset, external thermal relay, and inrush resistance overheat detection.
	Output signal **Open collector output (Five terminals)** **Relay output (One terminal)**	**Operating status**	The following signals can be assigned to *Pr. 11 to Pr. 16 (output terminal function selection)*: inverter run enable signal, converter reset, converter running, overload alarm, power supply phase detection, output voltage match, instantaneous power failure detection, regenerative drive recognition, electronic thermal relay pre-alarm, fan alarm, heatsink overheat pre-alarm, during retry, input current detection, zero current detection, life alarm, maintenance timer, instantaneous power failure detection hold, alarm, and fault output.
		For meter **Pulse train output** **(Max. 2.4kHz: one terminal)** **Analog output** **(Max. 10VDC: one terminal)**	The following signals can be assigned to *Pr. 54 FM terminal function selection (pulse train output)* and *Pr. 50 AM terminal function selection (analog output)*: power supply frequency, input current, input voltage, converter output voltage, electronic thermal relay load factor, input power, reference voltage output.
Indication	**Operation panel (FR-DU07-CNV)** **Parameter unit (FR-PU07)**	**Operating status**	Power supply frequency, input current, input voltage, fault or alarm indication, converter output voltage, electronic thermal relay load factor, cumulative energization time, cumulative power, input power, input power (with regenerative display), I/O terminal status*1, power/regenerative drive indication
		Fault record	Fault definition is displayed when a fault occurs. Past eight fault records and the data right before the fault (input voltage/current/bus voltage/cumulative energization) are stored.
		Interactive guidance *2	Function (help) for operation guide
Protective/warning function		**Protective function**	Overcurrent, overvoltage, converter protection thermal, fin overheat, instantaneous power failure, undervoltage, input phase loss, HC2 dedicated board disconnection, input power supply fault, external thermal relay operation *4, parameter error, PU disconnection *4, retry count excess *4, converter CPU fault, operation panel power supply short circuit, 24VDC power output short circuit, input current detection value exceeded *4, inrush current limit circuit fault, internal circuit fault, option fault *5, communication option fault *5.
		Warning functions	Fan alarm, overload signal detection, electronic thermal relay pre-alarm, PU stop, maintenance timer alarm *4, parameter write error, copy operation error, operation panel lock, parameter copy alarm, no-phase detection
Environment	**Surrounding air temperature**		-10°C to +50°C (non-freezing)
	Ambient humidity		90%RH or less (non-condensing)
	Storage temperature*3		-20°C to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)
	Altitude/ vibration		Maximum 1,000m above sea level, 5.9m/s^2 or less *6 at 10 to 55Hz (directions of X, Y, Z axes)

*1 Can be displayed only on the operation panel (FR-DU07-CNV).
*2 Can be displayed only on the option parameter unit (FR-PU07).
*3 Temperature applicable for a short time, e.g. in transit.
*4 This protective function is not available in the initial status.
*5 This protective function is enabled when FR-A7NC is mounted.
*6 2.9m/s^2 or less for the 280K or higher.

6.3 Outline dimensions

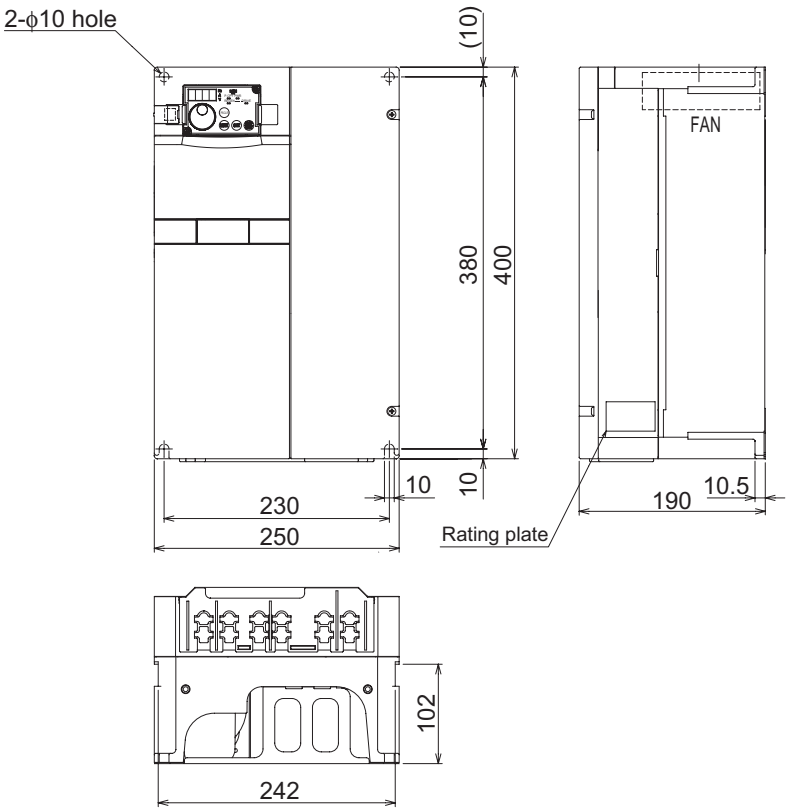
6.3.1 Converter (FR-HC2)

●FR-HC2-7.5K



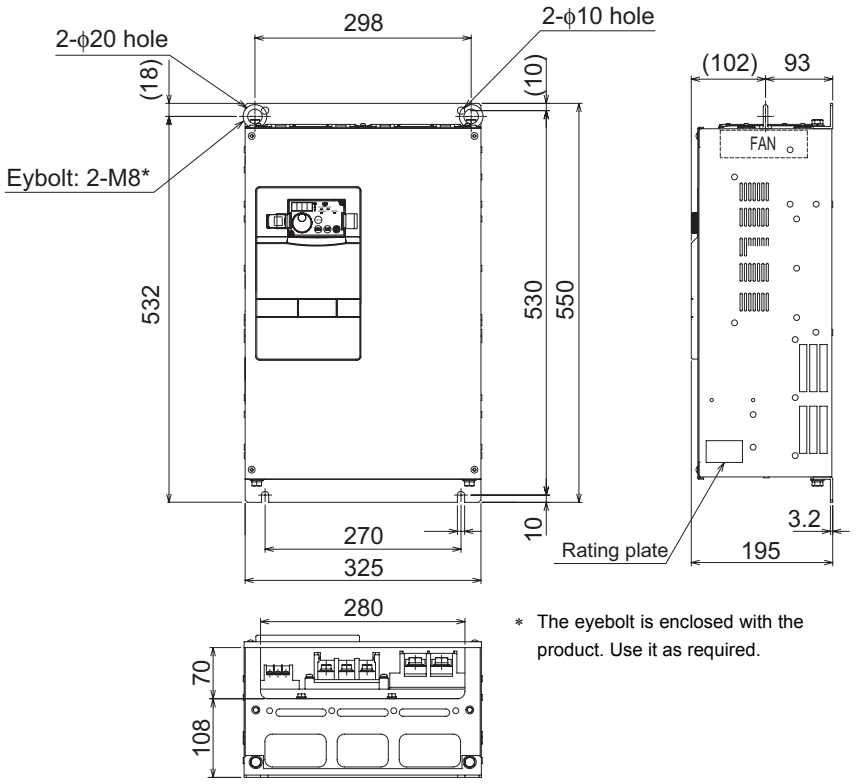
(Unit: mm)
Mass: 7kg

●FR-HC2-15K



(Unit: mm)
Mass: 12kg

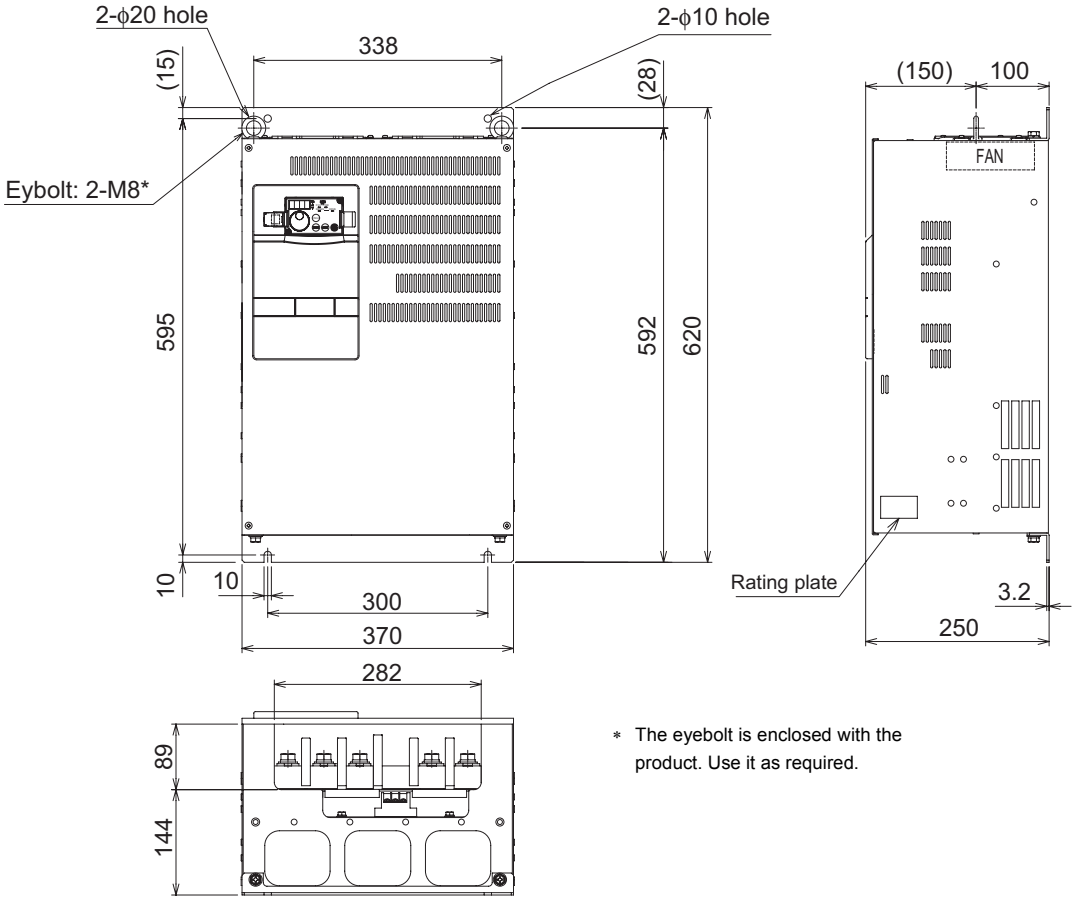
●**FR-HC2-30K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 24kg

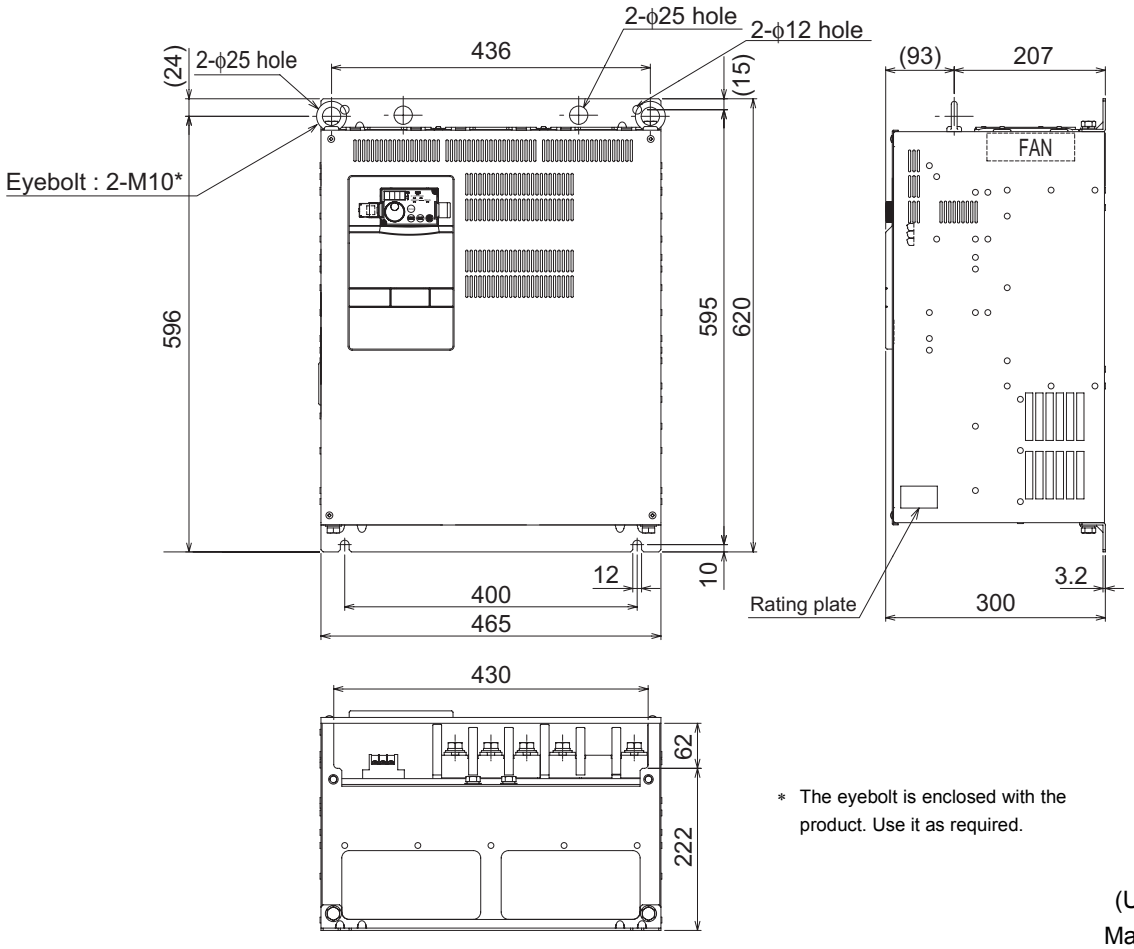
●**FR-HC2-55K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 39kg

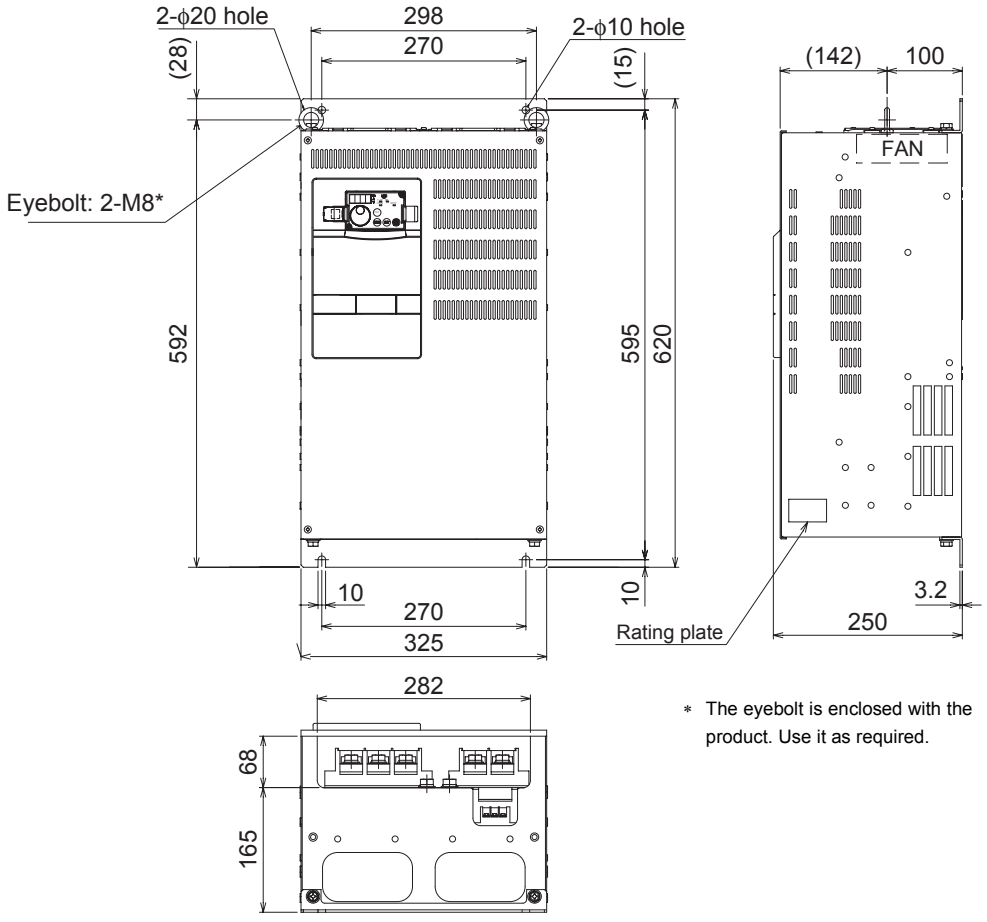
●**FR-HC2-75K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 53kg

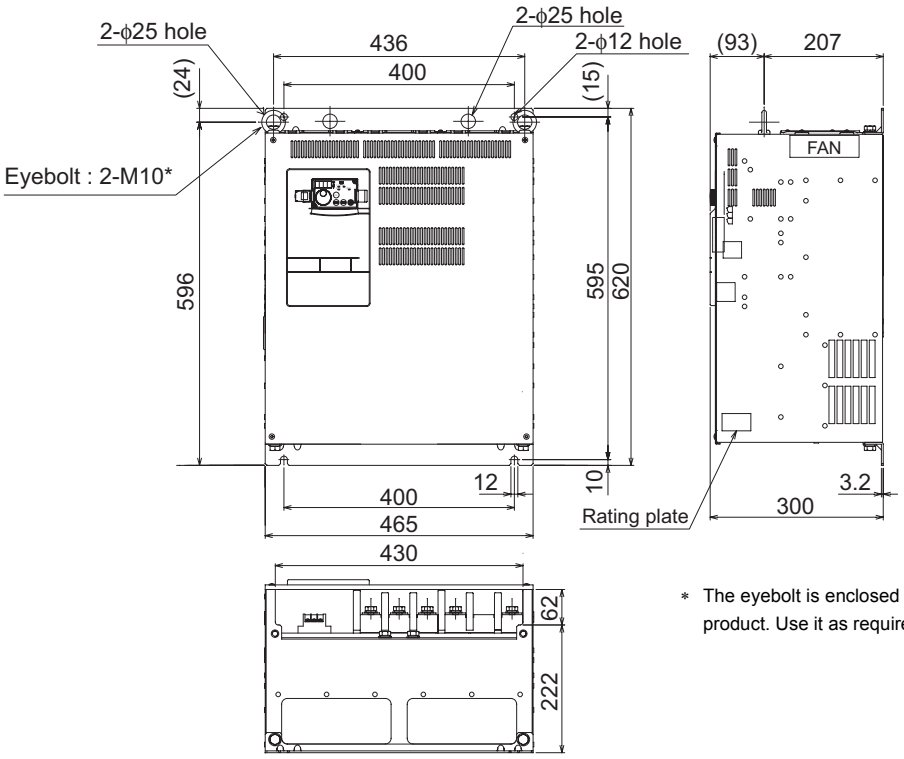
●**FR-HC2-H75K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 37kg

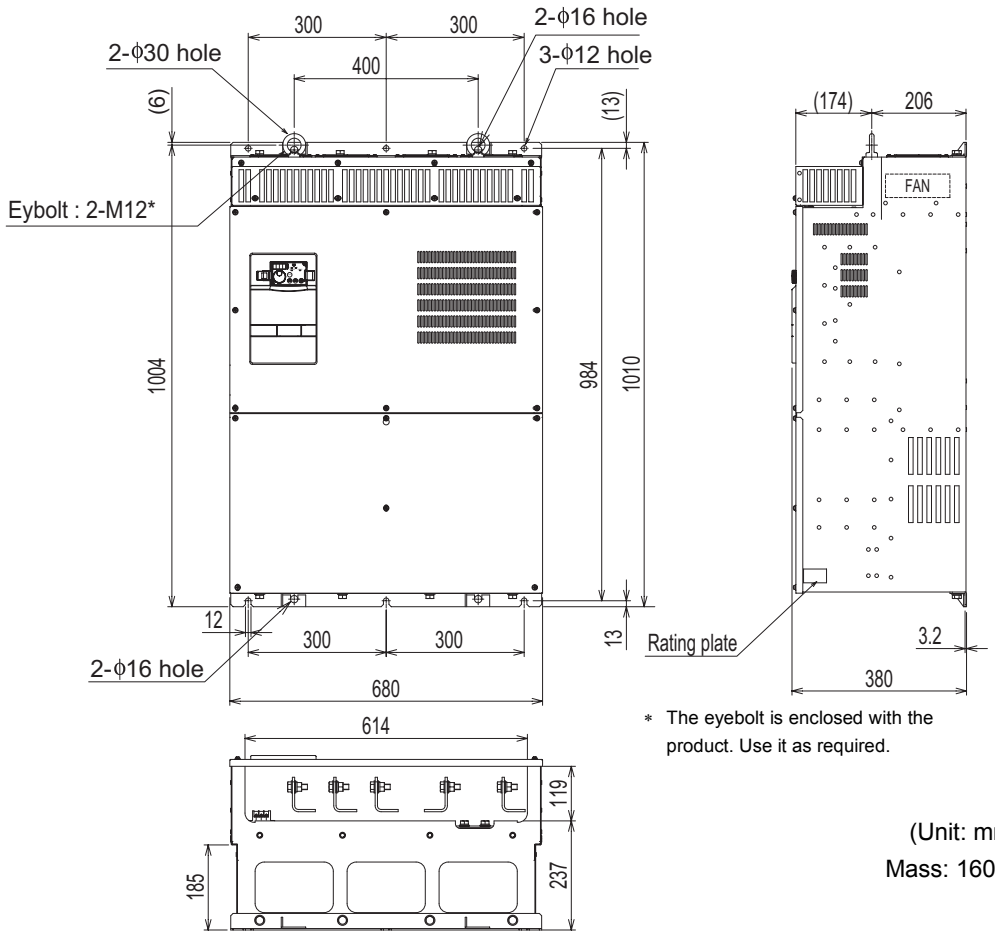
●**FR-HC2-H110K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 56kg

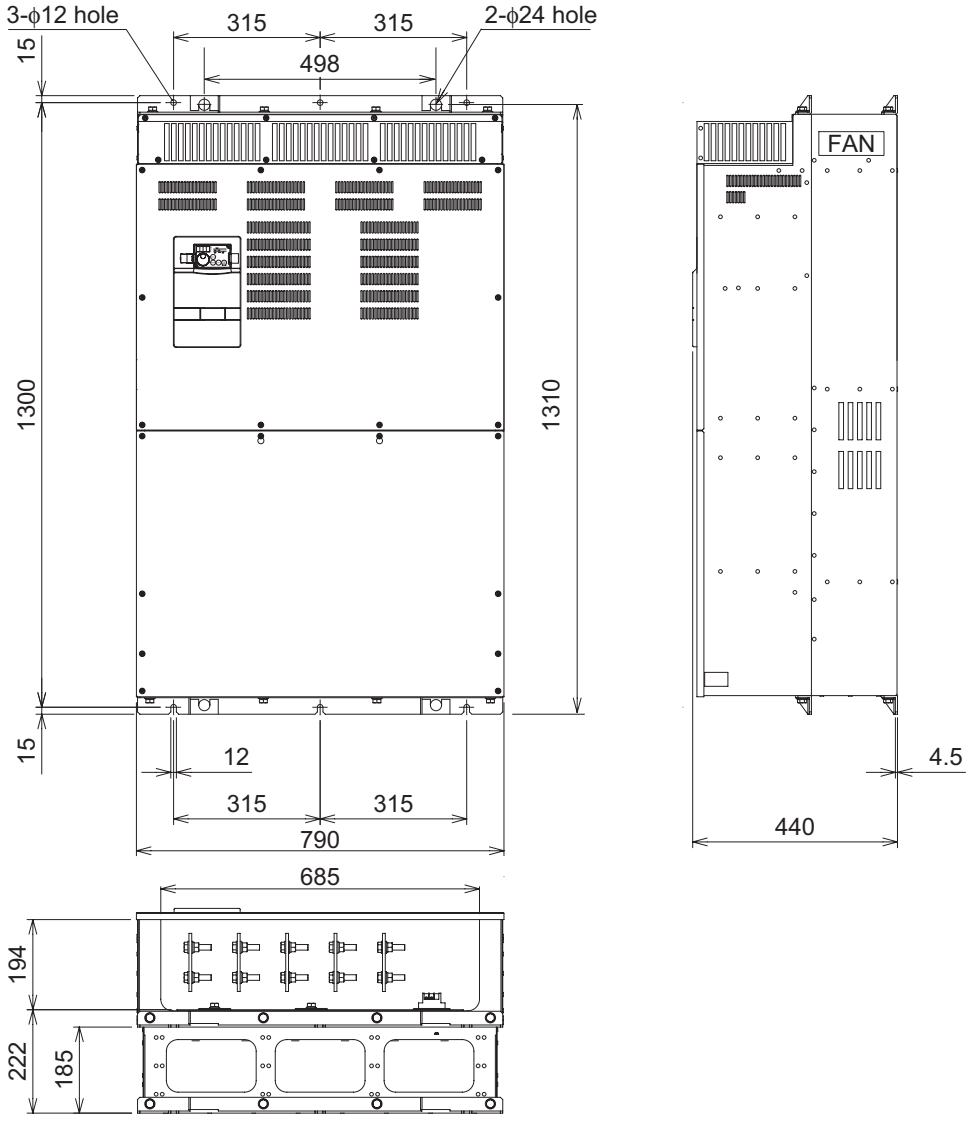
●**FR-HC2-H280K**



* The eyebolt is enclosed with the product. Use it as required.

(Unit: mm)
Mass: 160kg

●**FR-HC2-H560K**

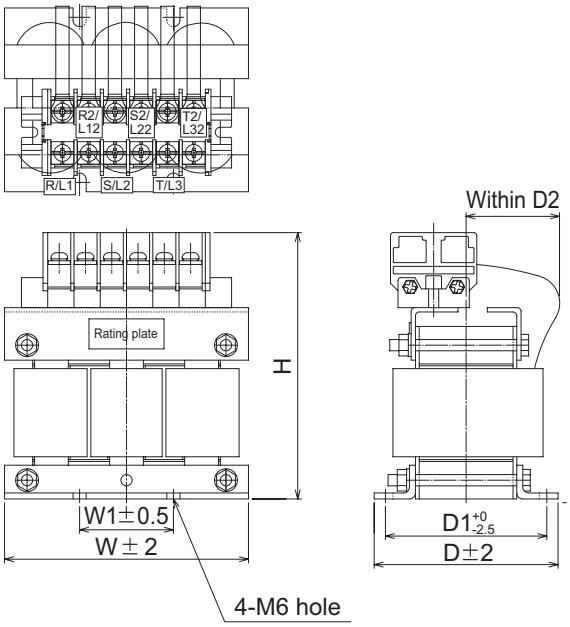


(Unit: mm)
Mass: 250kg

6.3.2 Reactor 1 (FR-HCL21)

Check that the capacity of the reactor 1 is same as the capacity of the converter.

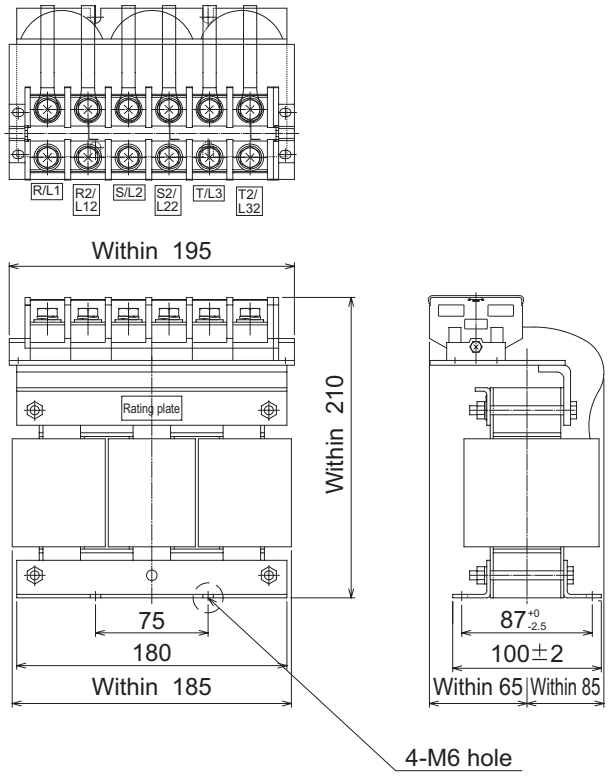
●FR-HCL21-7.5K, 15K



Model	W	W1	H	D	D1	D2	Mass
FR-HCL21-7.5K	130	50	Within 150	98	86	50	4.2kg
FR-HCL21-15K	160	75	167±5	124	107	60	7.0kg

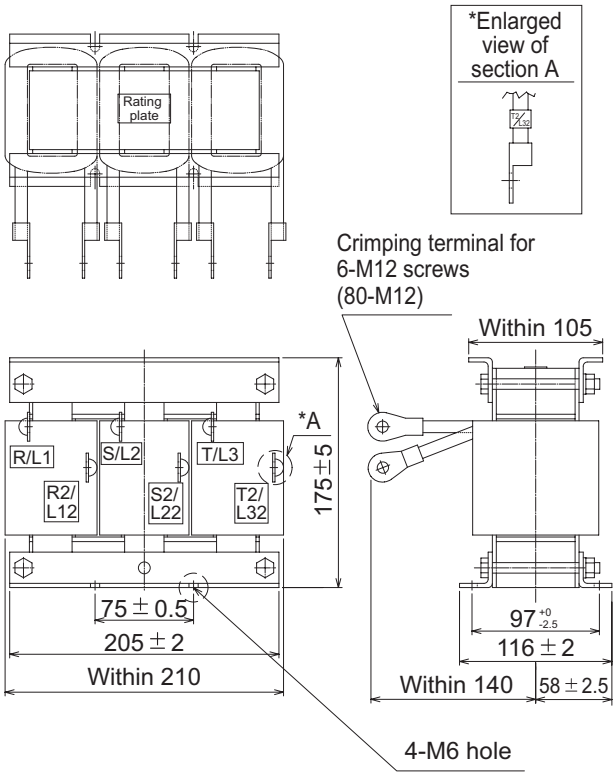
(Unit: mm)

●FR-HCL21-30K



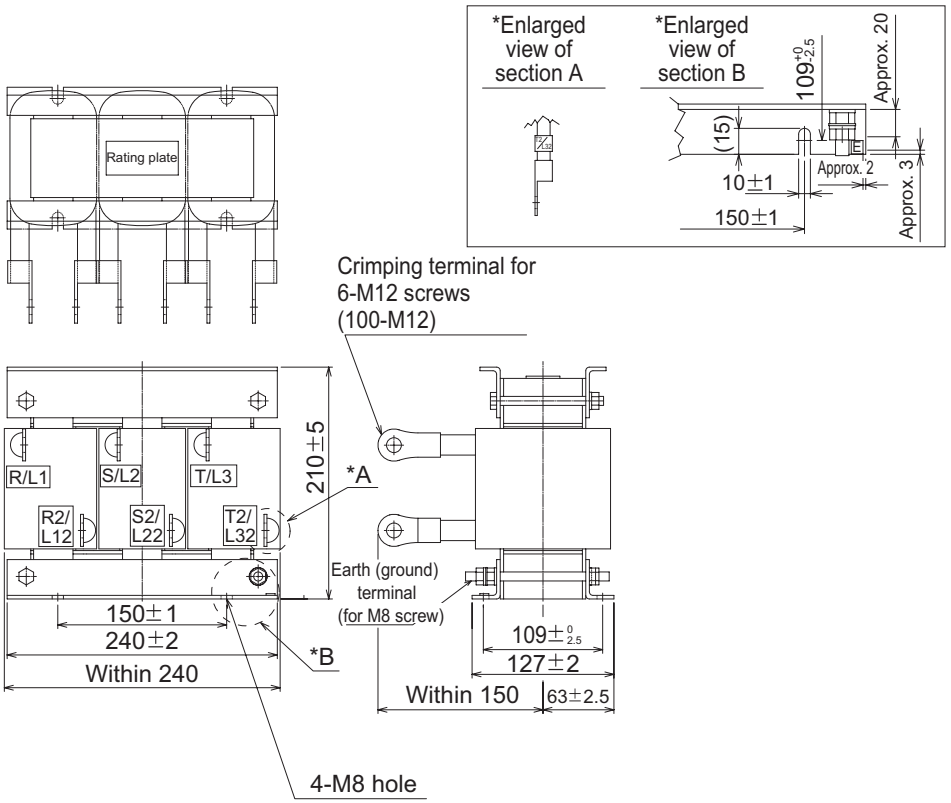
(Unit: mm)
Mass: 9.7kg

●**FR-HCL21-55K**



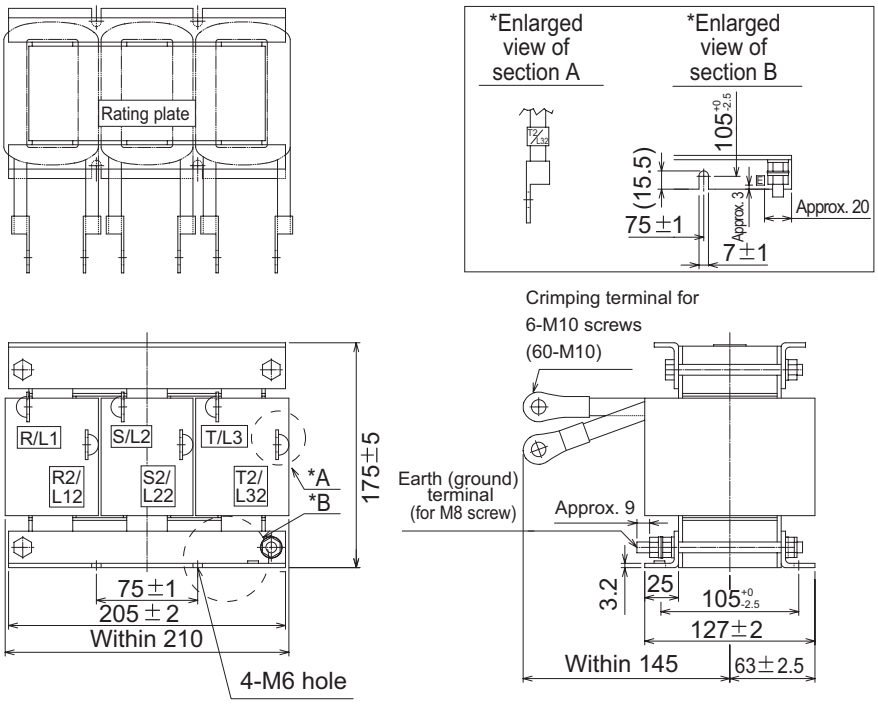
(Unit: mm)
Mass: 17.4kg

●**FR-HCL21-75K**



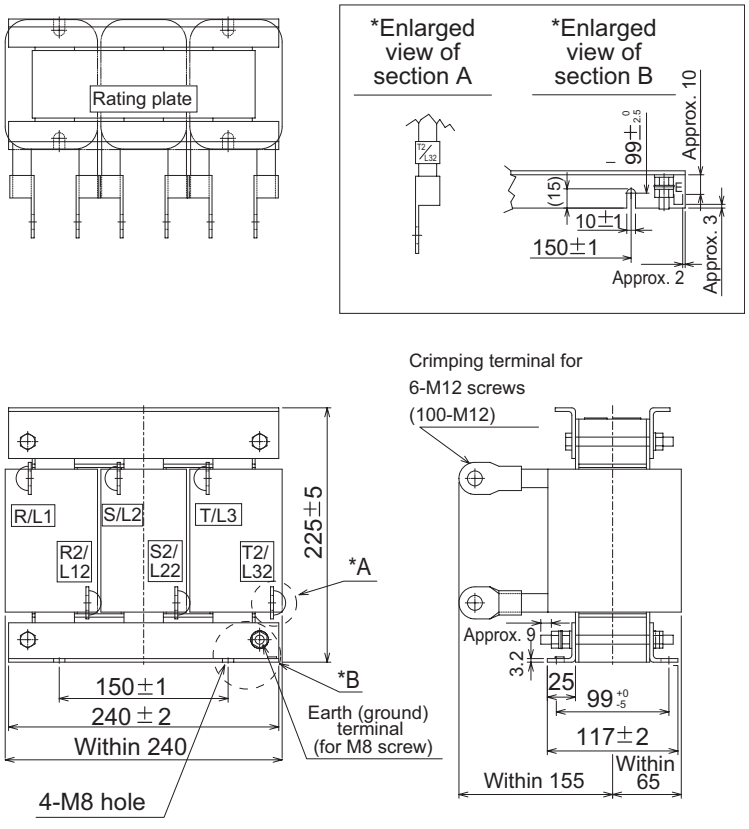
(Unit: mm)
Mass: 23kg

●**FR-HCL21-H75K**



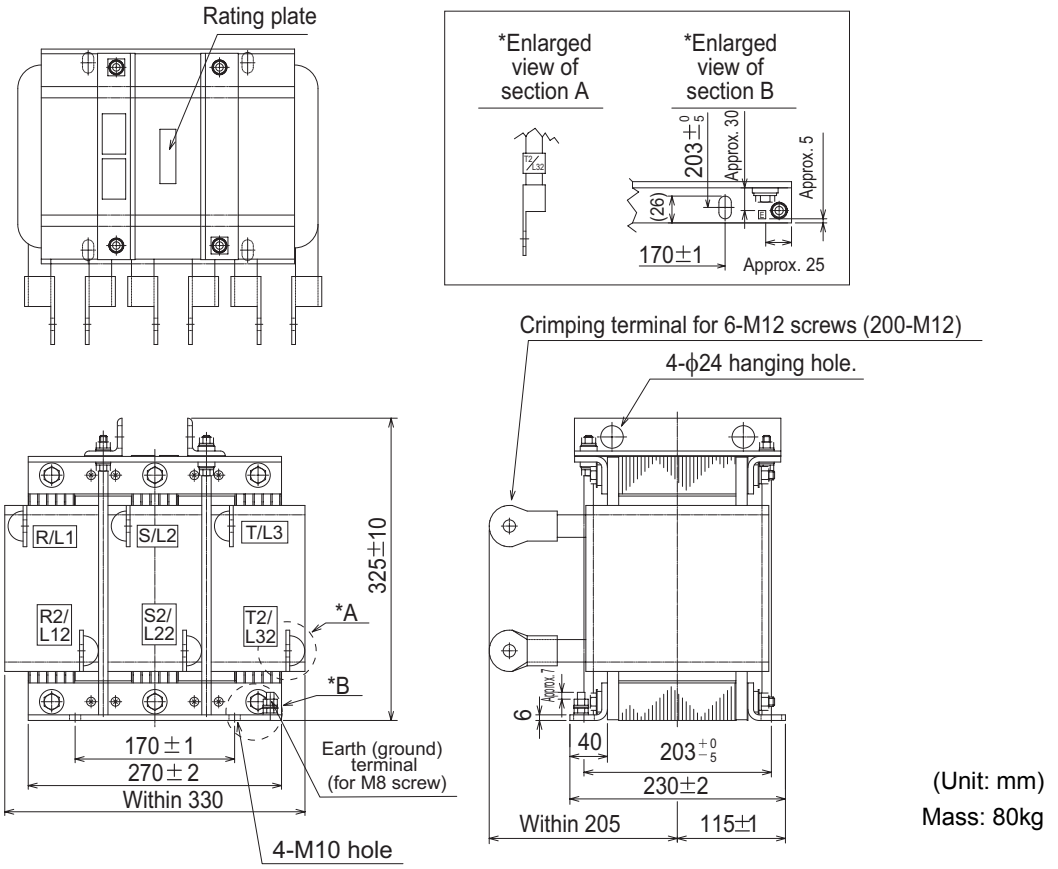
(Unit: mm)
Mass: 20kg

●**FR-HCL21-H110K**



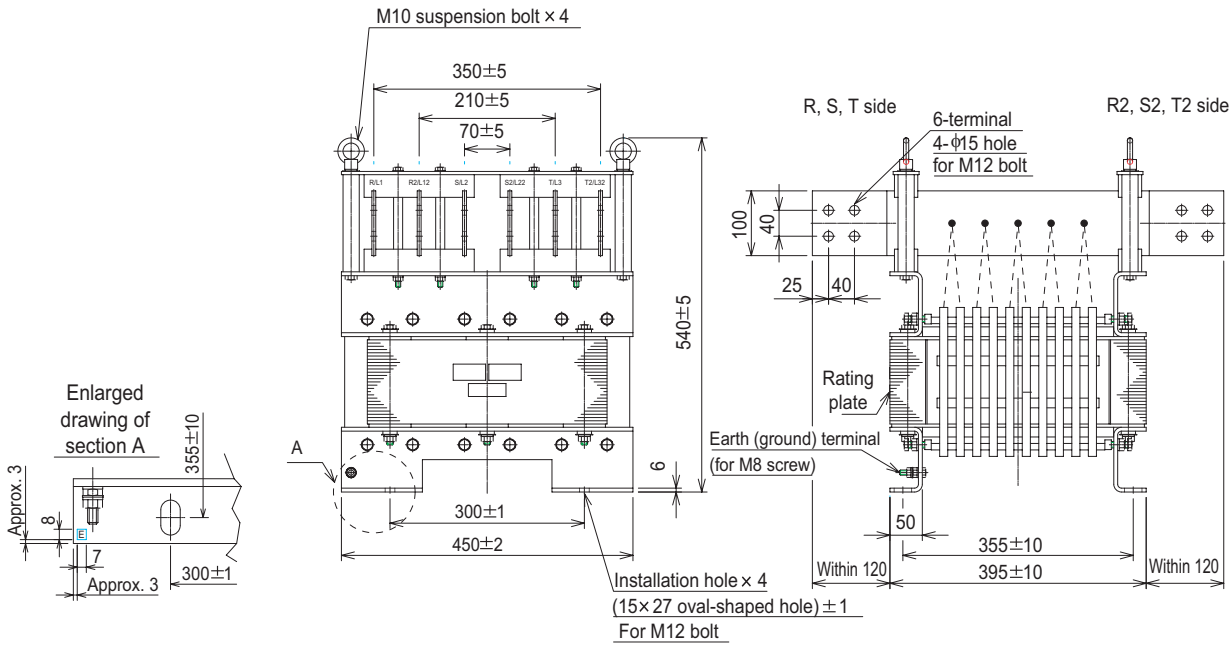
(Unit: mm)
Mass: 28kg

●**FR-HCL21-H280K**



(Unit: mm)
Mass: 80kg

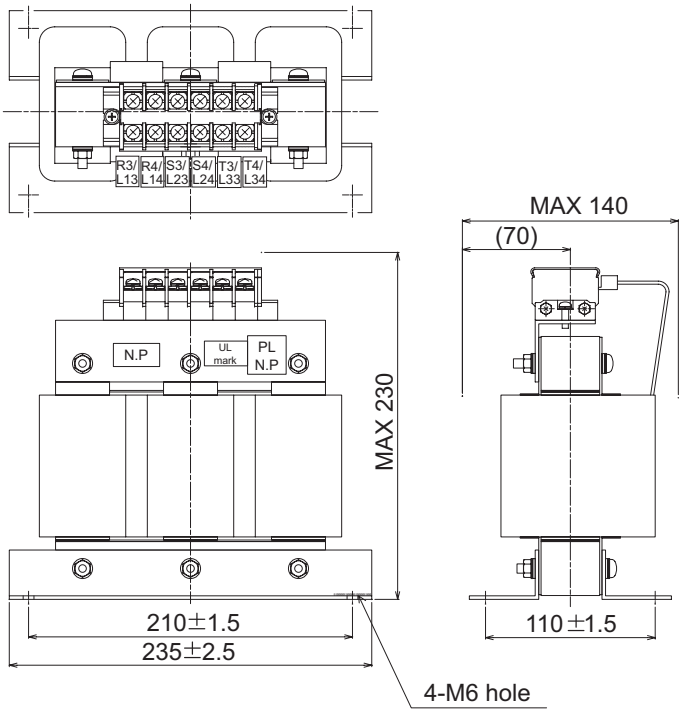
●**FR-HCL21-H560K**



6.3.3 Reactor 2 (FR-HCL22)

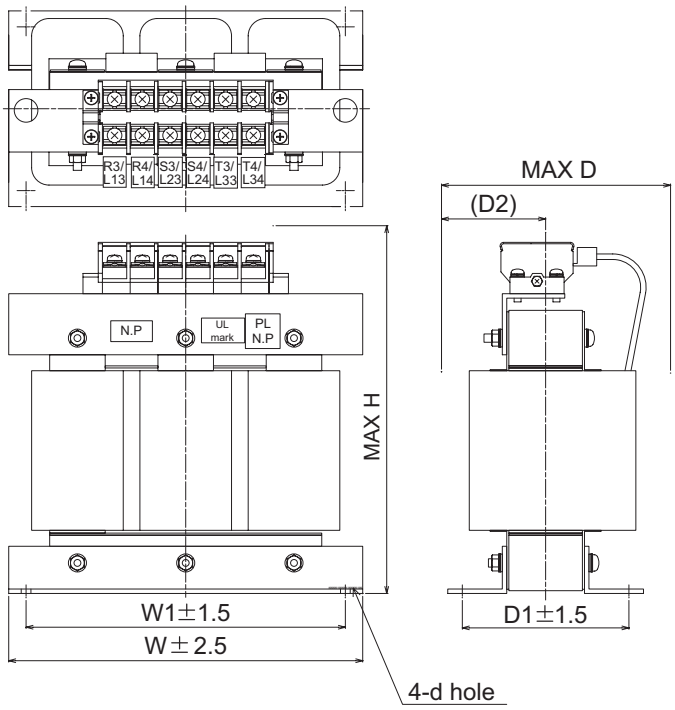
Check that the capacity of the reactor 2 is same as the capacity of the converter.

●FR-HCL22-7.5K



(Unit: mm)
Mass: 9.8kg

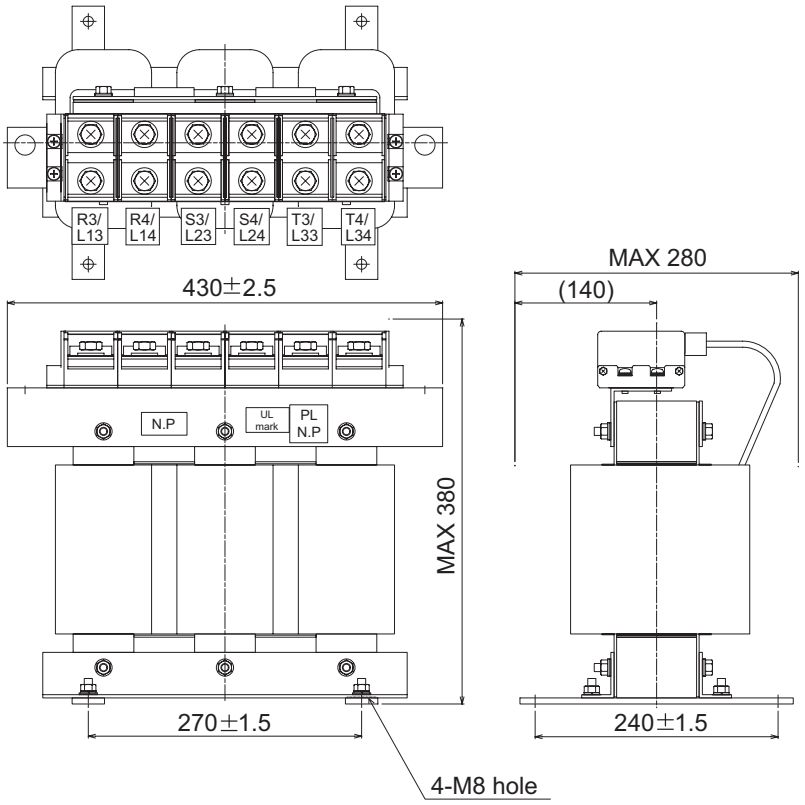
●FR-HCL22-15K, 30K



Model	W	W1	H	D	D1	D2	d	Mass
FR-HCL22-15K	255	230	260	165	120	75	M6	19kg
FR-HCL22-30K	340	310	305	180	130	80	M8	36kg

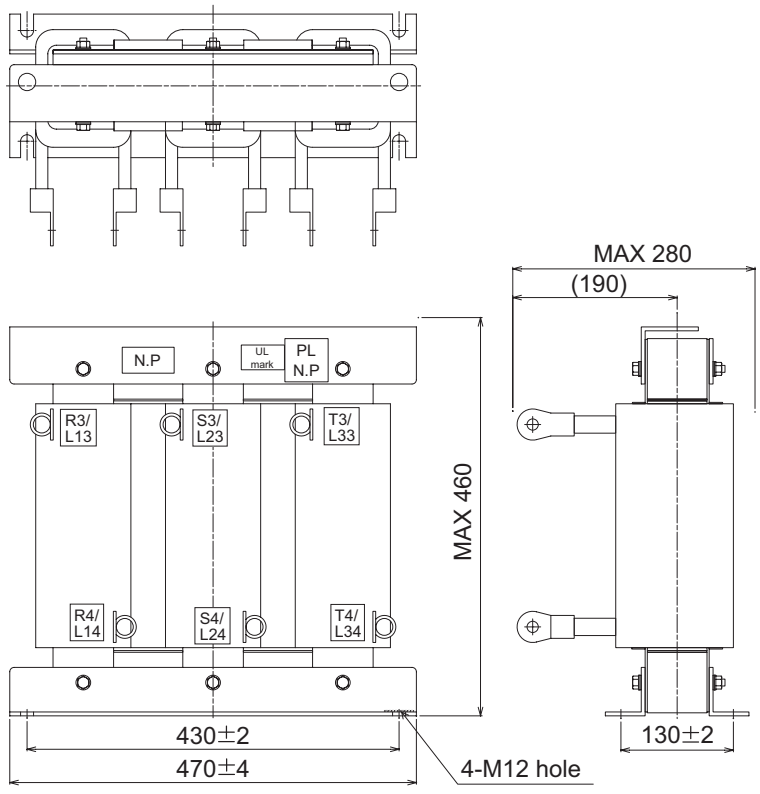
(Unit: mm)

●**FR-HCL22-55K**



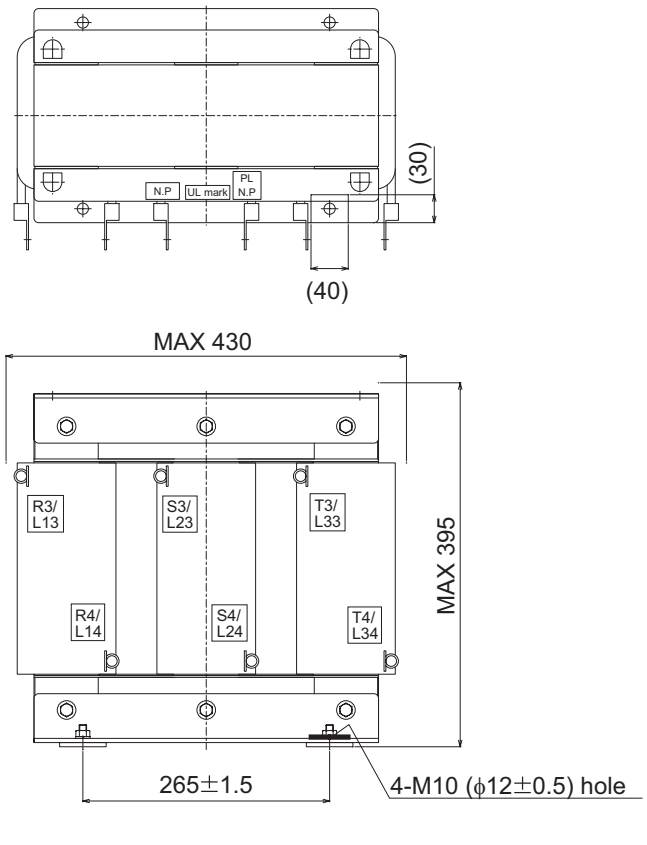
(Unit: mm)
Mass: 65kg

●**FR-HCL22-75K**



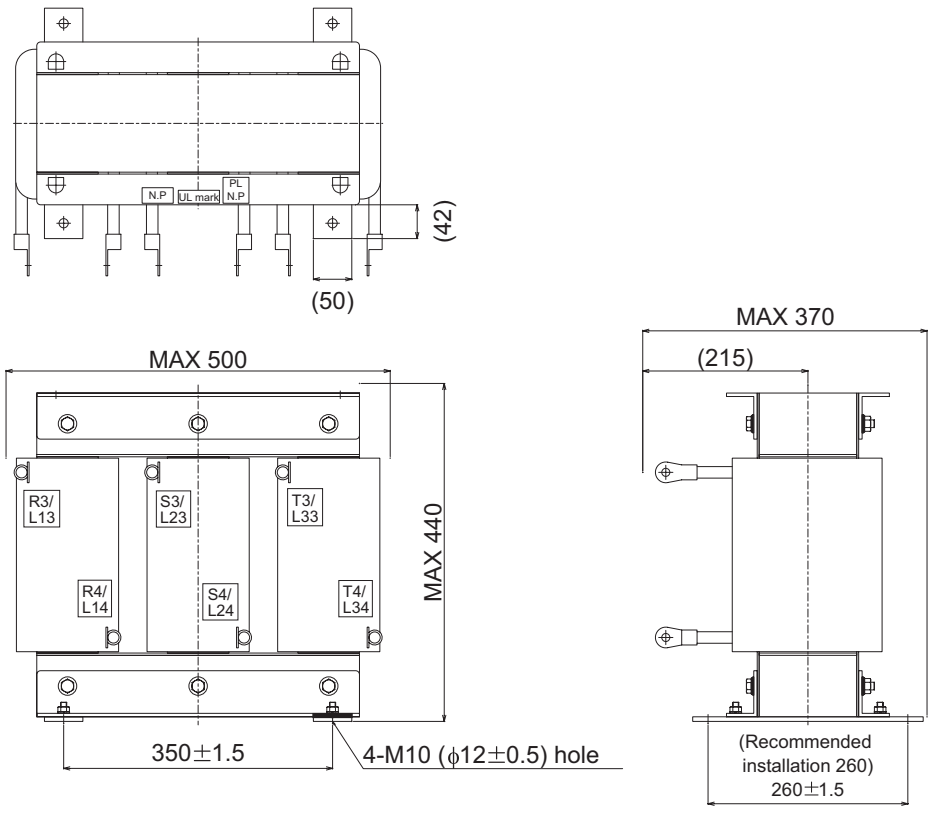
(Unit: mm)
Mass: 98kg

●**FR-HCL22-H75K**



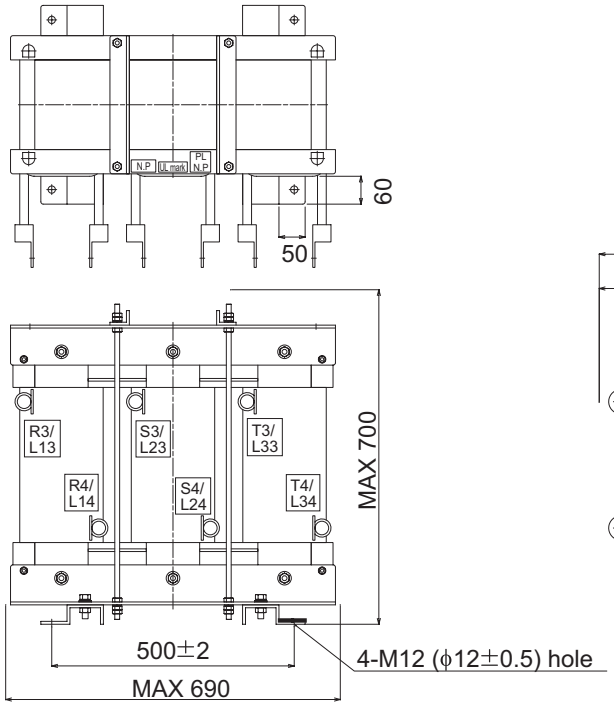
(Unit: mm)
Mass: 120kg

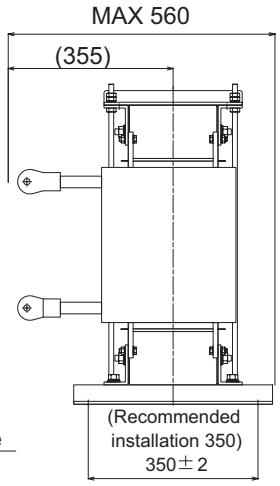
●**FR-HCL22-H110K**



(Unit: mm)
Mass: 175kg

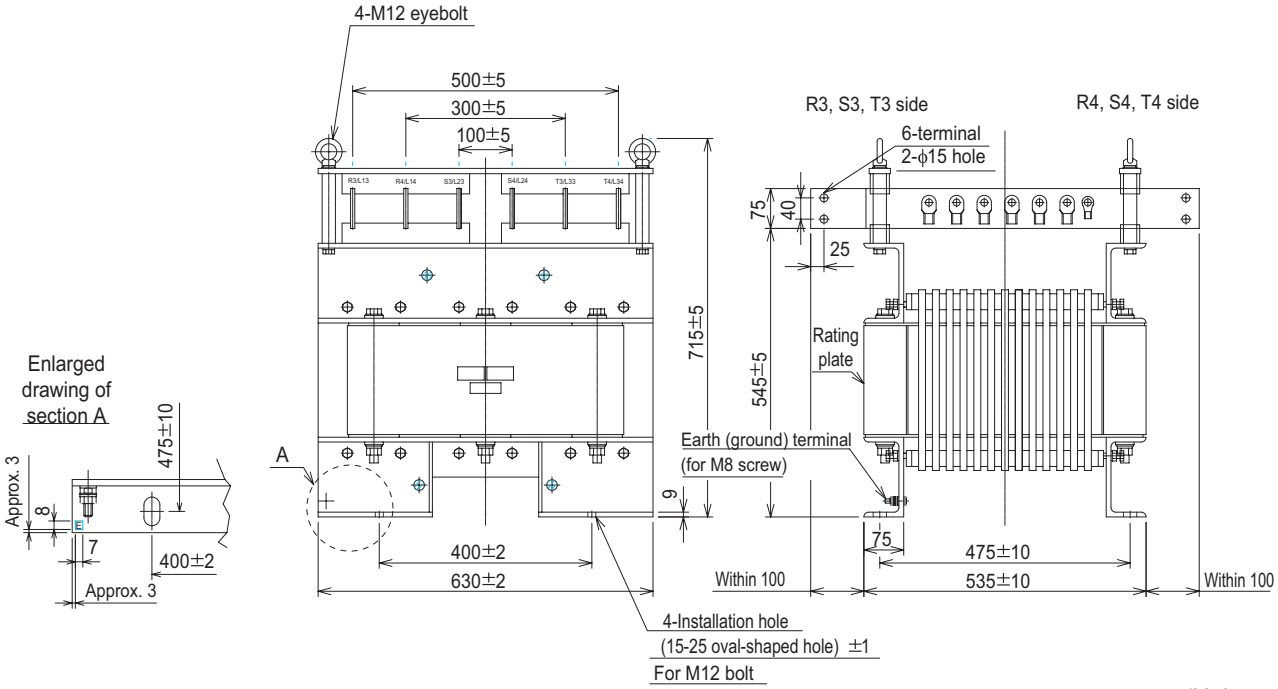
●**FR-HCL22-H280K**





(Unit: mm)
Mass: 450kg

●**FR-HCL22-H560K**

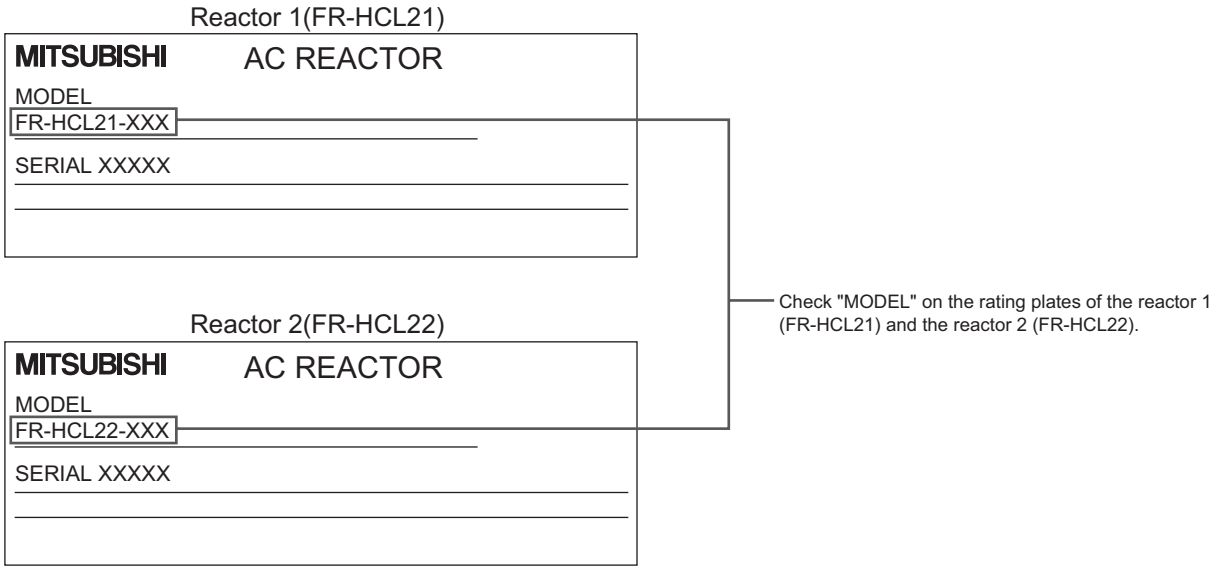


(Unit: mm)
Mass: 507kg

6.3.4 Difference between the reactor 1 (FR-HCL21) and the reactor 2 (FR-HCL22).

Each reactor has a rating plate. Identify the reactor 1 and the reactor 2 by their rating plates. Incorrect connection order of the reactor 1 and the reactor 2 causes the reactors to heat up, and it is dangerous. Take caution to avoid the danger.

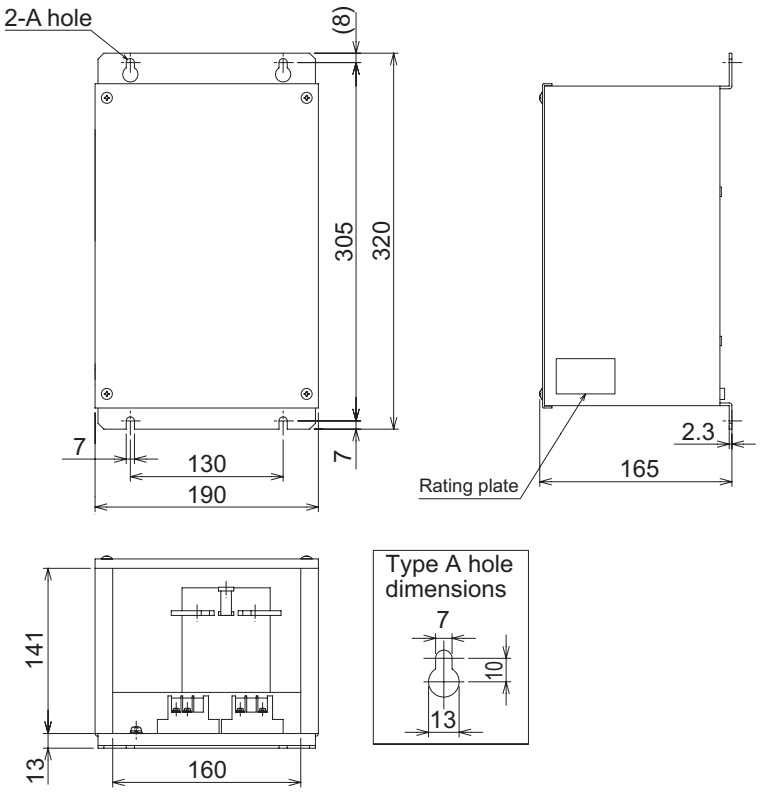
[Rating plate]



6.3.5 Outside box (FR-HCB2)

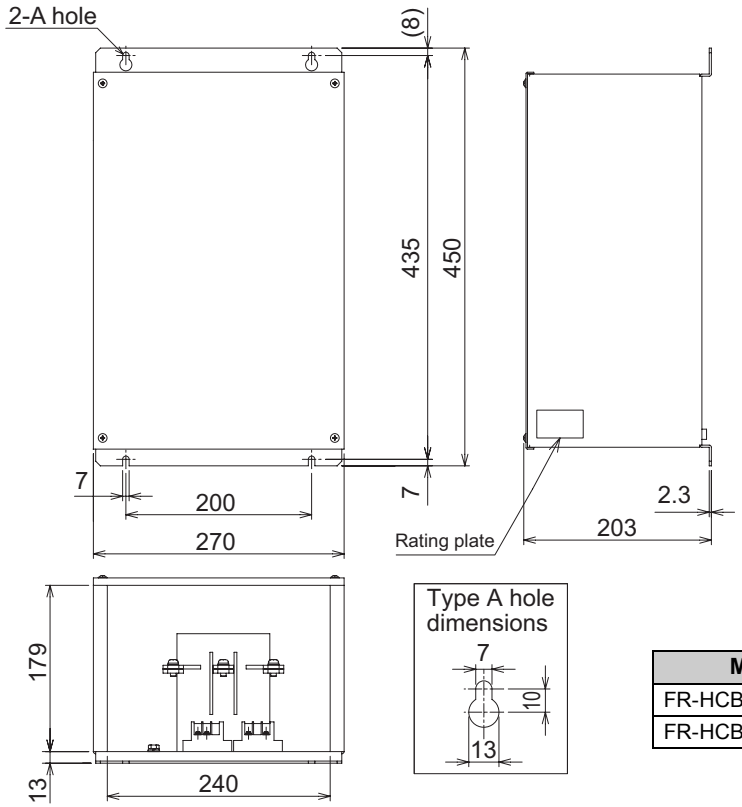
(1) Outline drawing

●FR-HCB2-7.5K, 15K



(Unit: mm)
Mass: 7kg

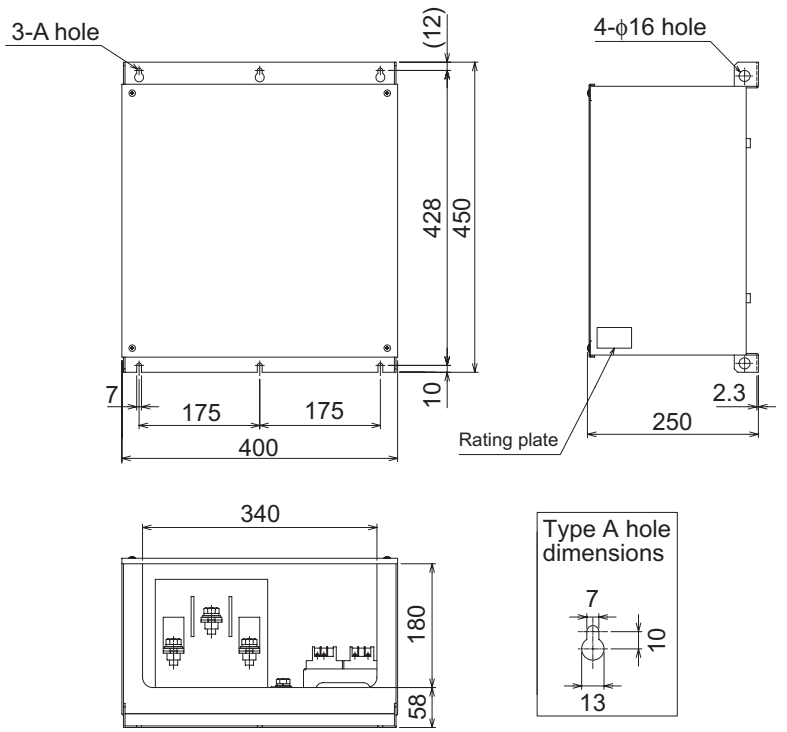
●FR-HCB2-30K, 55K



Model	Mass
FR-HCB2-30K	11kg
FR-HCB2-55K	13kg

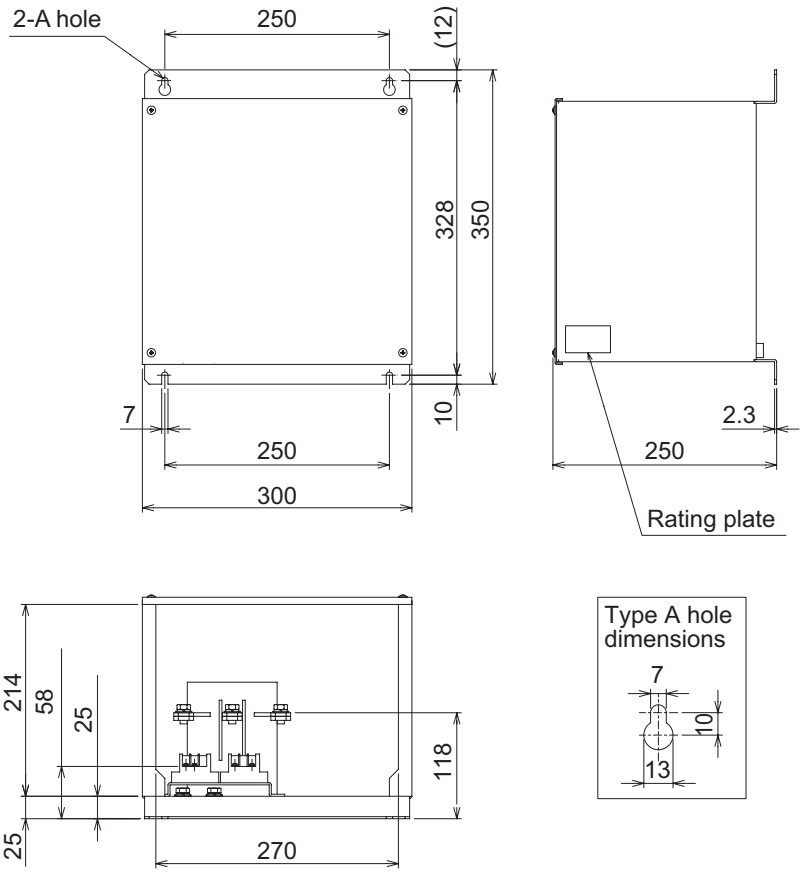
(Unit: mm)

●**FR-HCB2-75K**



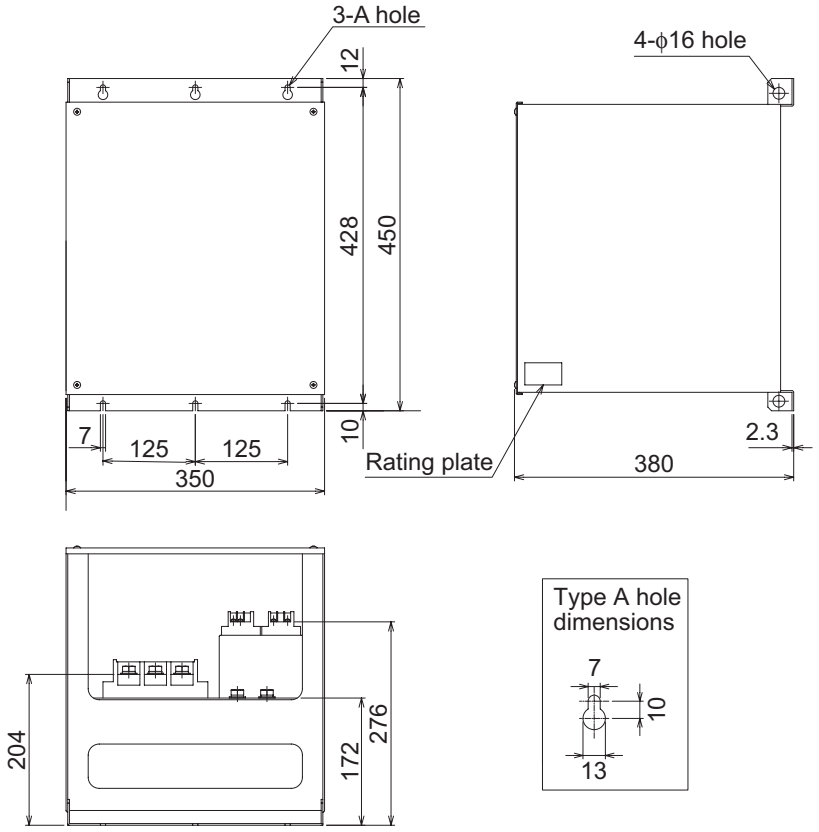
(Unit: mm)
Mass: 27kg

●**FR-HCB2-H75K**



(Unit: mm)
Mass: 16kg

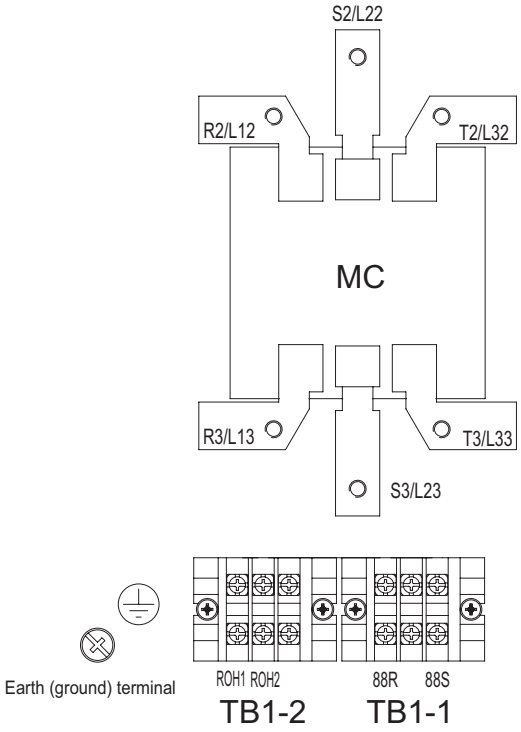
●**FR-HCB2-H110K**



(Unit: mm)
Mass: 37kg

(2) Terminal block

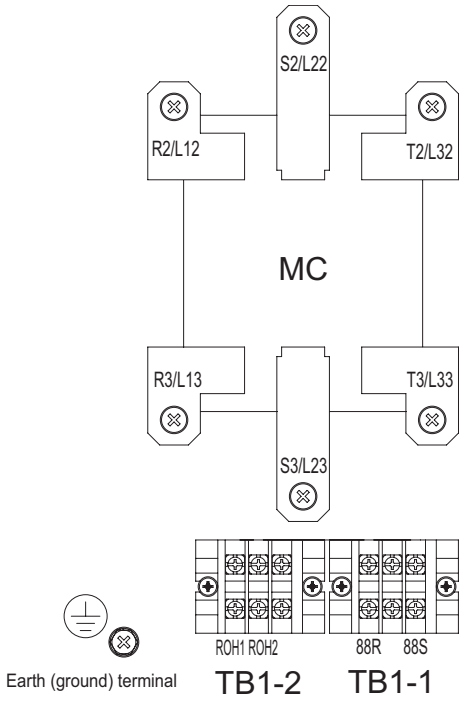
●FR-HCB2-7.5K, 15K



<Terminal screw size>

Model	MC	TB1-1	TB1-2	Earth (ground) terminal
FR-HCB2-7.5K, 15K	M5	M3.5	M3.5	M5

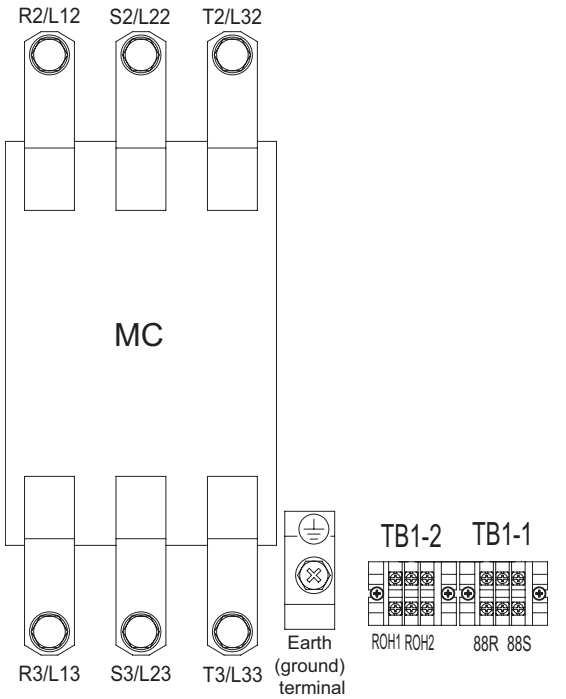
●FR-HCB2-30K, 55K



<Terminal screw size>

Model	MC	TB1-1	TB1-2	Earth (ground) terminal
FR-HCB2-30K	M6	M3.5	M3.5	M6
FR-HCB2-55K	M8	M3.5	M3.5	M6

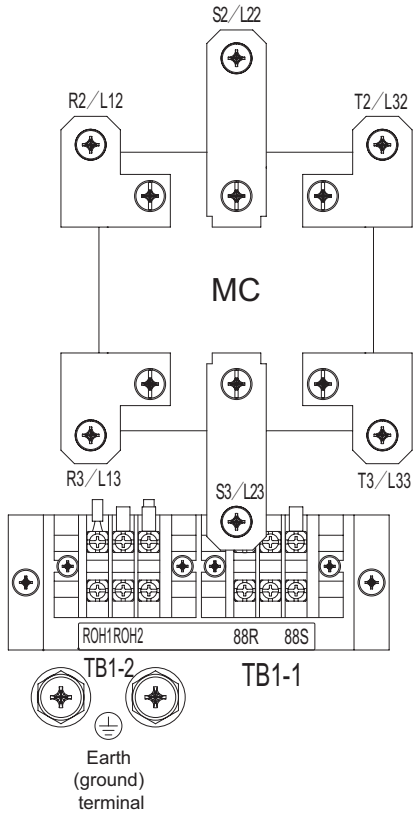
●FR-HCB2-75K



<Terminal screw size>

Model	MC	TB1-1	TB1-2	Earth (ground) terminal
FR-HCB2-75K	M12	M3.5	M3.5	M10

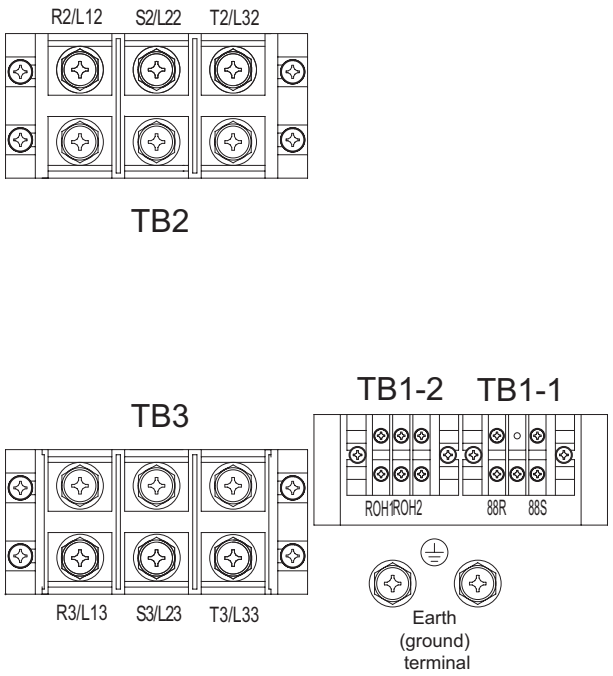
●**FR-HCB2-H75K**



<Terminal screw size>

Model	MC	TB1-1	TB1-2	Earth (ground) terminal
FR-HCB2-H75K	M8	M3.5	M3.5	M8

●**FR-HCB2-H110K**

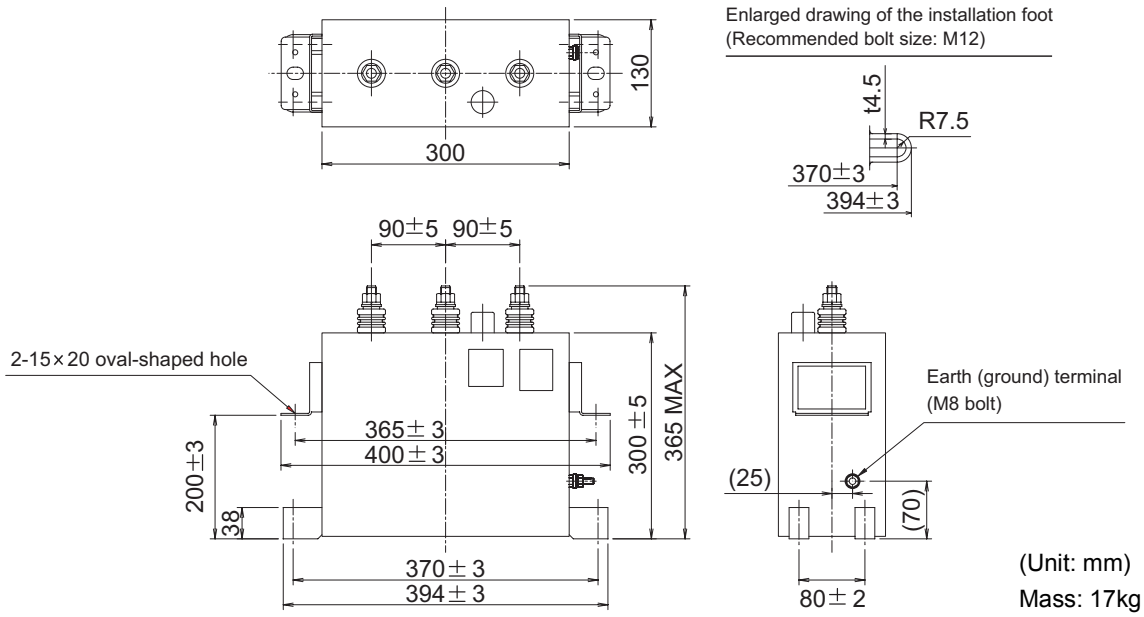


<Terminal screw size>

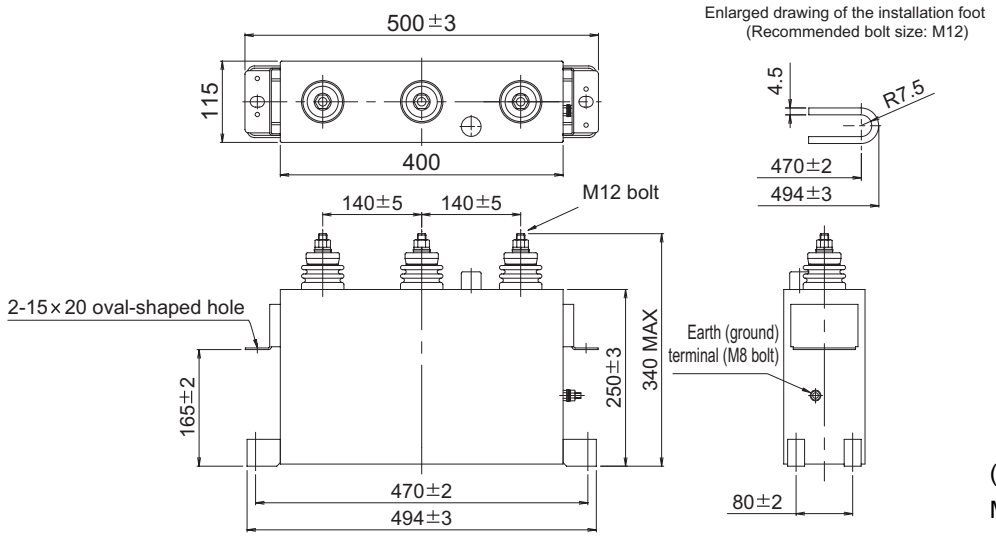
Model	TB2, TB3	TB1-1	TB1-2	Earth (ground) terminal
FR-HCB2-H110K	M10	M3.5	M3.5	M10

6.3.6 Filter capacitor (FR-HCC2)

●**FR-HCC2-H280K**



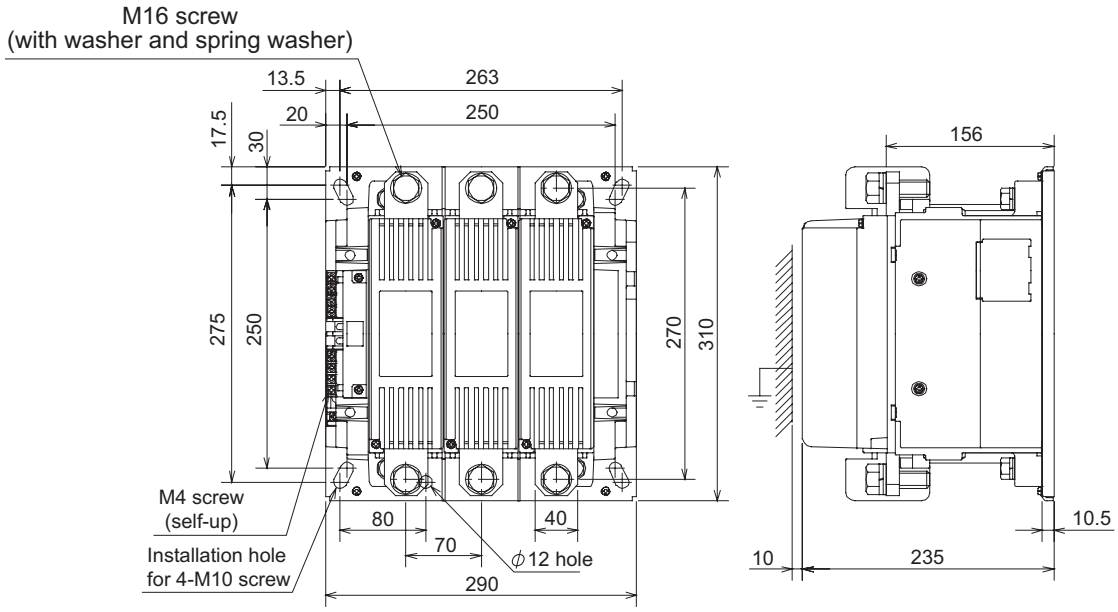
●**FR-HCC2-H560K**



(Unit: mm)
Mass: 21kg

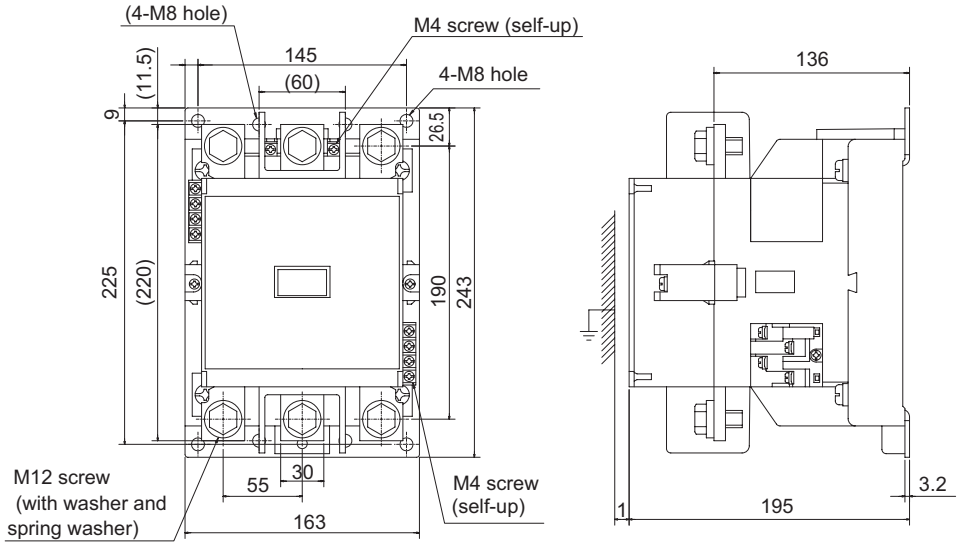
6.3.7 FR-HCM2

●**Contactor (S-N600FXYS) (FR-HCM2-H280K)**



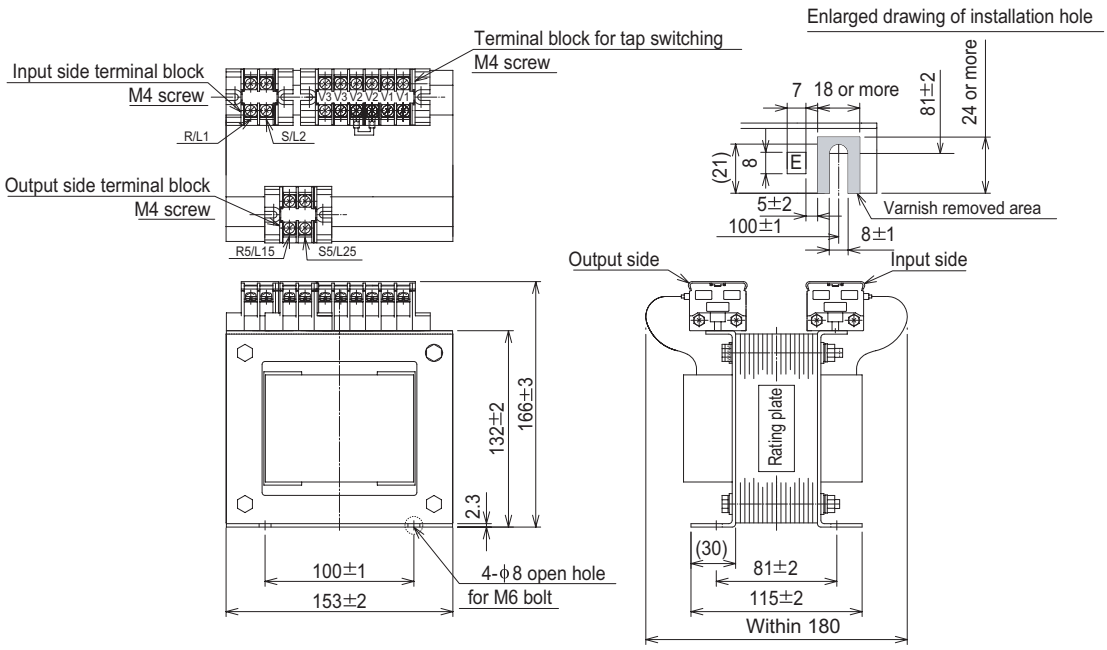
(Unit: mm)
Mass: 24kg

●**Contactor (S-N400FXYS) (FR-HCM2-H560K)**



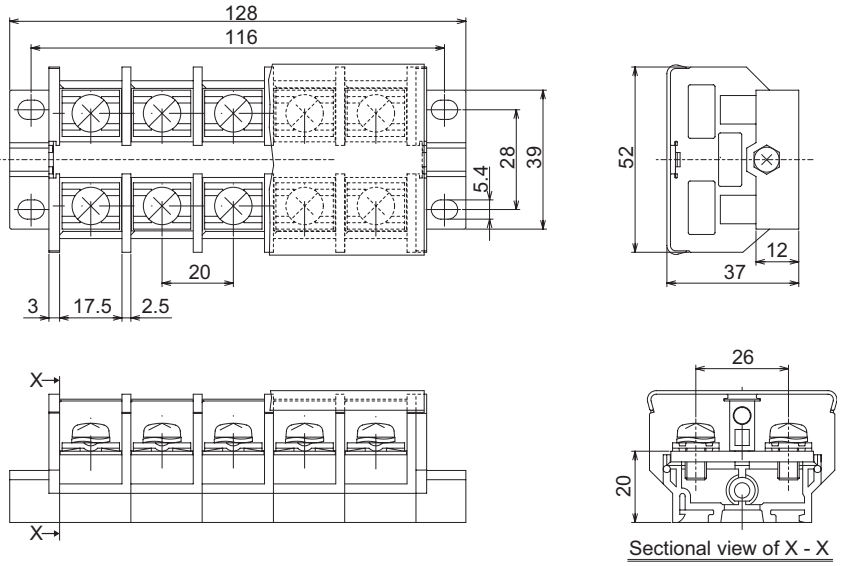
(Unit: mm)
Mass: 9.5kg

●Stepdown transformer (BKO-CA2001H06) (FR-HCM2-H280K/ H560K)



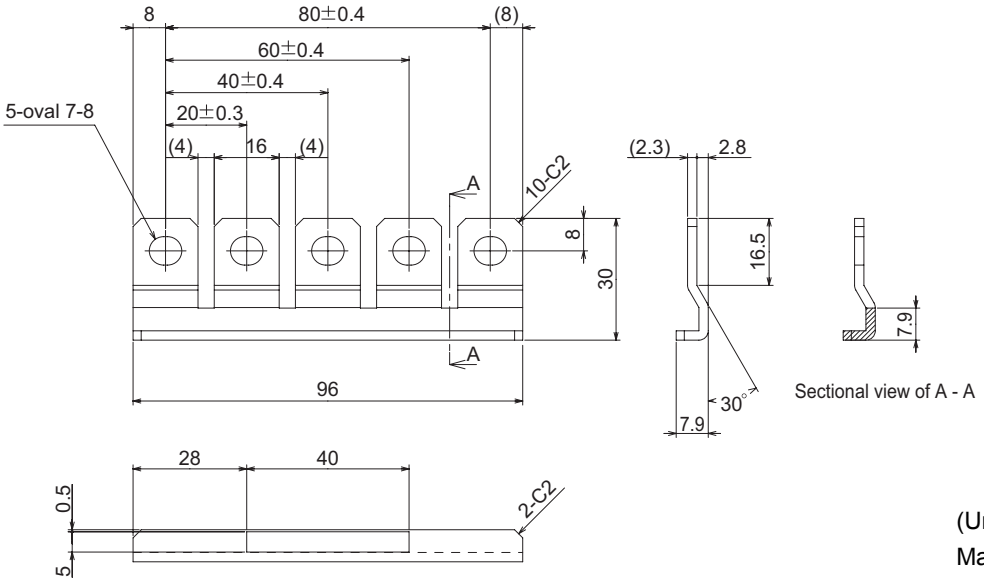
(Unit: mm)
Mass: 10kg

●Terminal block (TS-807B-5P) (FR-HCM2-H280K)



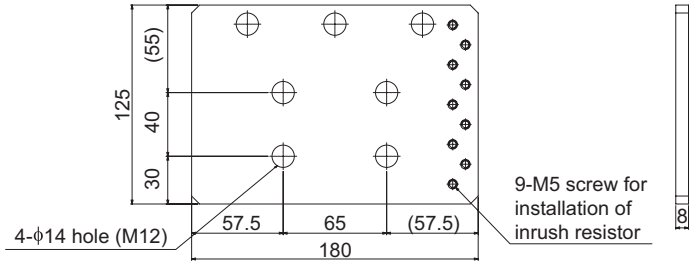
(Unit: mm)
Mass: 0.3kg

●Terminal block shorting conductor (C152C481H21) (FR-HCM2-H280K)



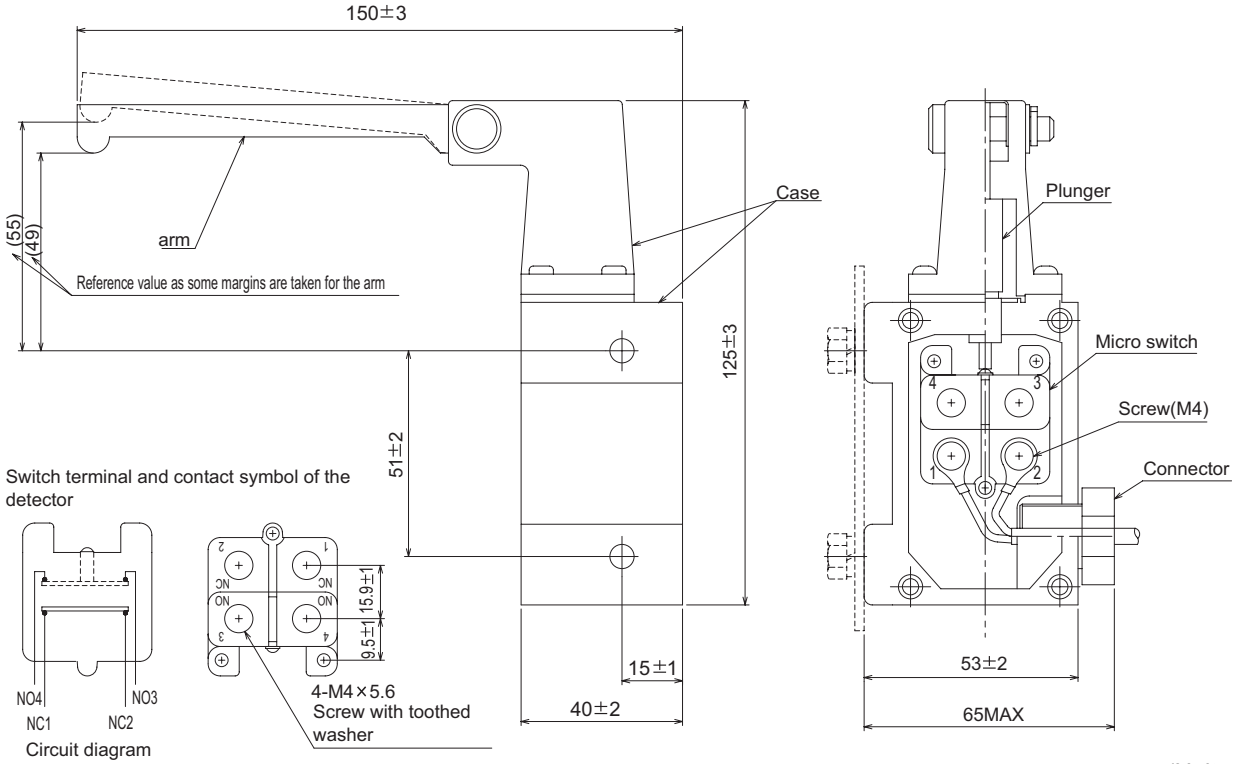
(Unit: mm)
Mass: 0.1kg

●MC shorting conductor (C152C423H21) (FR-HCM2-H560K)



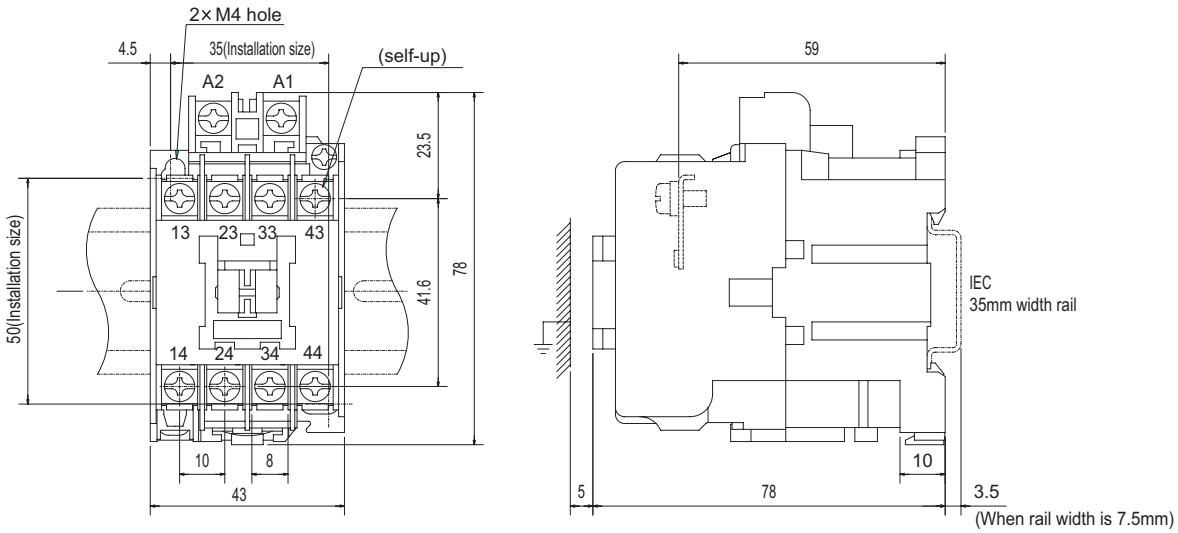
(Unit: mm)
Mass: 1.6kg

●Filter capacitor alarm detector (MDA-1) (FR-HCM2-H560K)



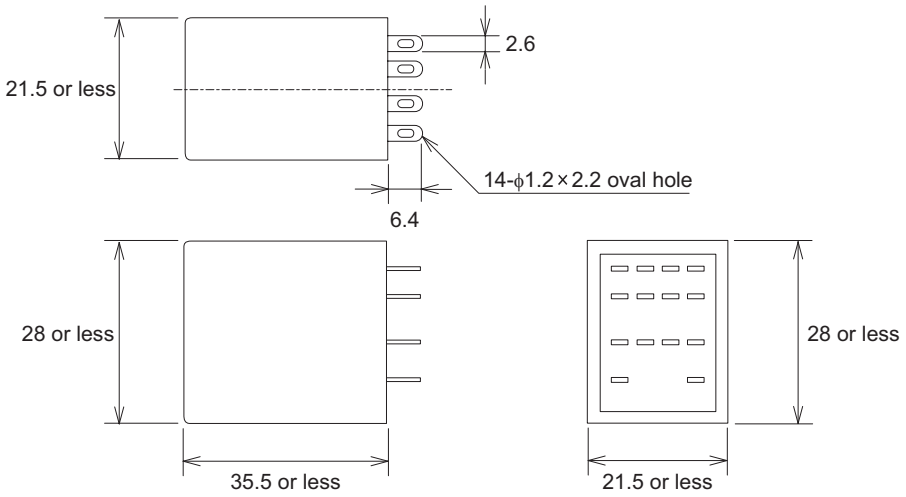
(Unit: mm)
Mass: 0.3kg

●Buffer relay for driving MCs (SR-N4FX AC210V 4A) (FR-HCM2-H280K/H560K)



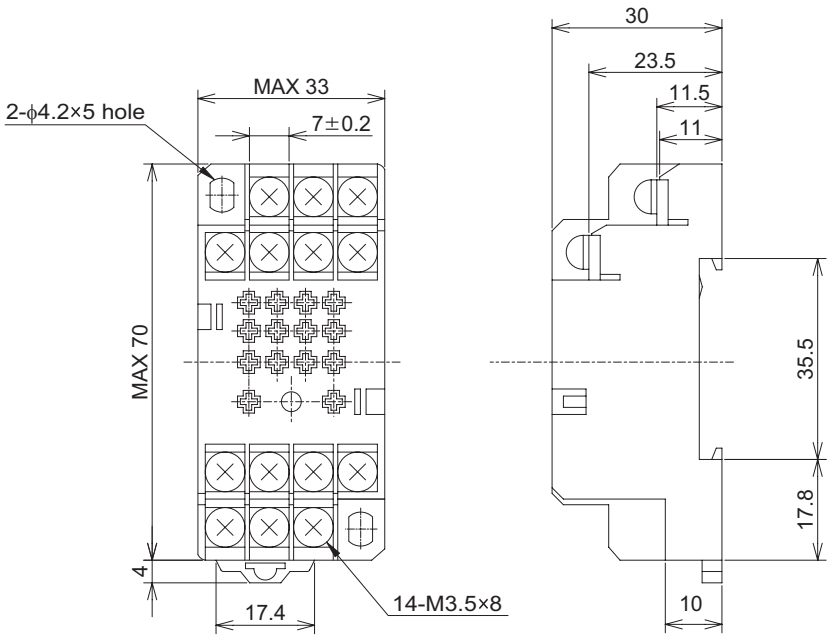
(Unit: mm)
Mass: 0.3kg

●Mini relay for filter capacitor alarm detector (MYQ4Z AC200/220) (FR-HCM2-H560K)



(Unit: mm)
Mass: 35kg

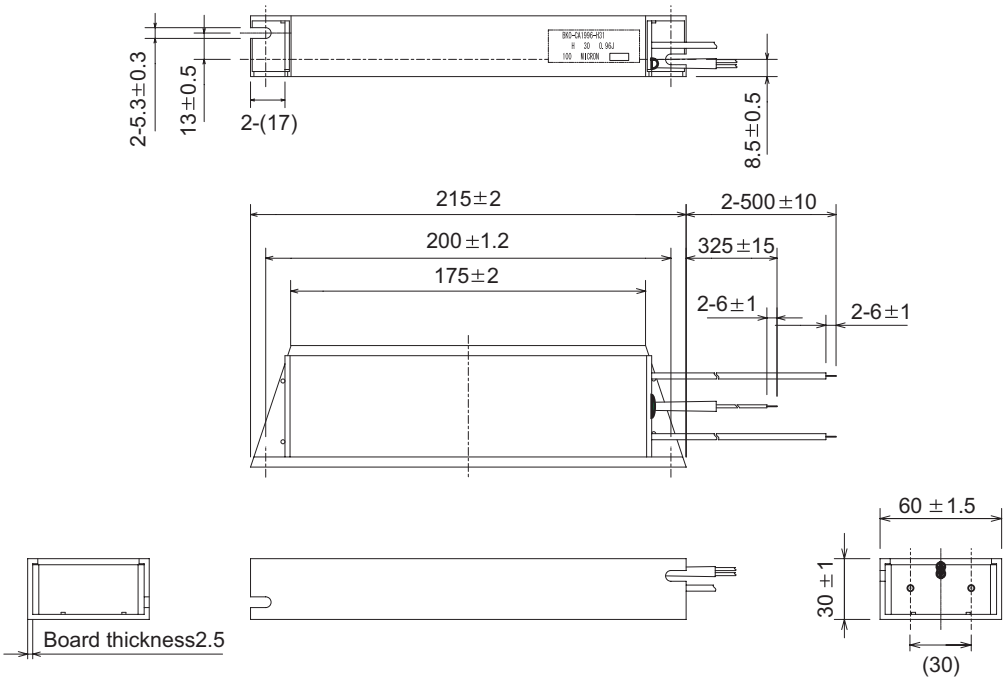
●Mini relay terminal block (PYF14T) (FR-HCM2-H560K)



(Unit: mm)
Mass: 53kg

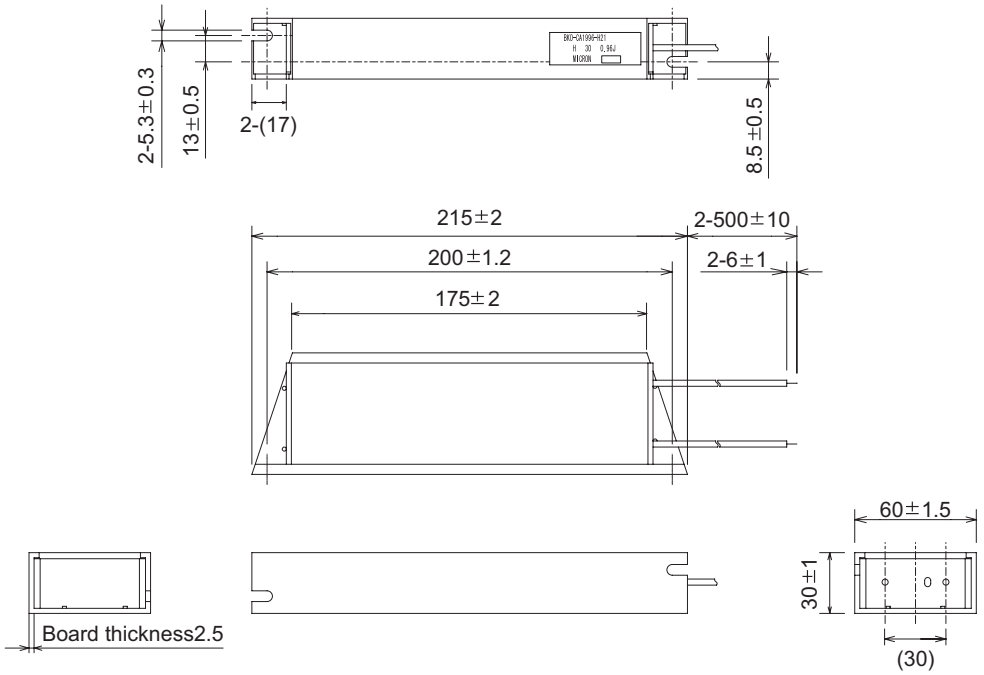
6.3.8 Inrush current limit resistor (FR-HCR2)

● With thermostat (BKO-CA1996H31) (FR-HCR2-H280K/H560K)



(Unit: mm)
Mass: 0.8kg

●Without thermostat (BKO-CA1996H21) (FR-HCR2-H280K/H560K)

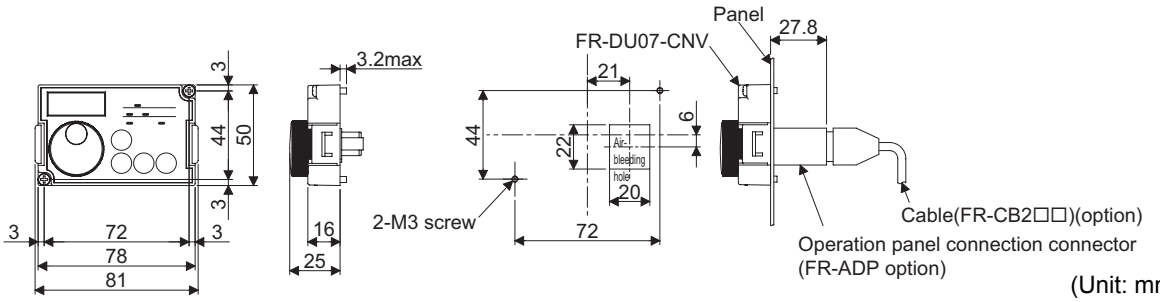


(Unit: mm)
Mass: 0.8kg

6.3.9 Parameter unit

●Operation panel (FR-DU07-CNV)

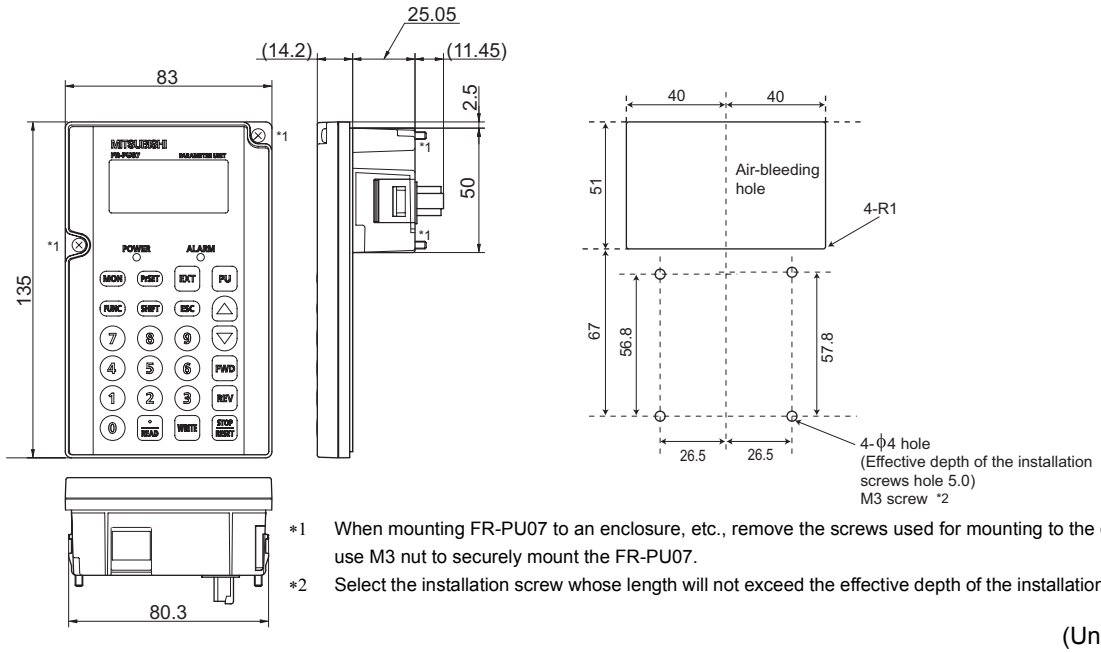
[Outline drawing] [Enclosure cut dimension drawing]



(Unit: mm)

●Parameter unit (option) (FR-PU07)

[Outline drawing] [Enclosure cut dimension drawing]



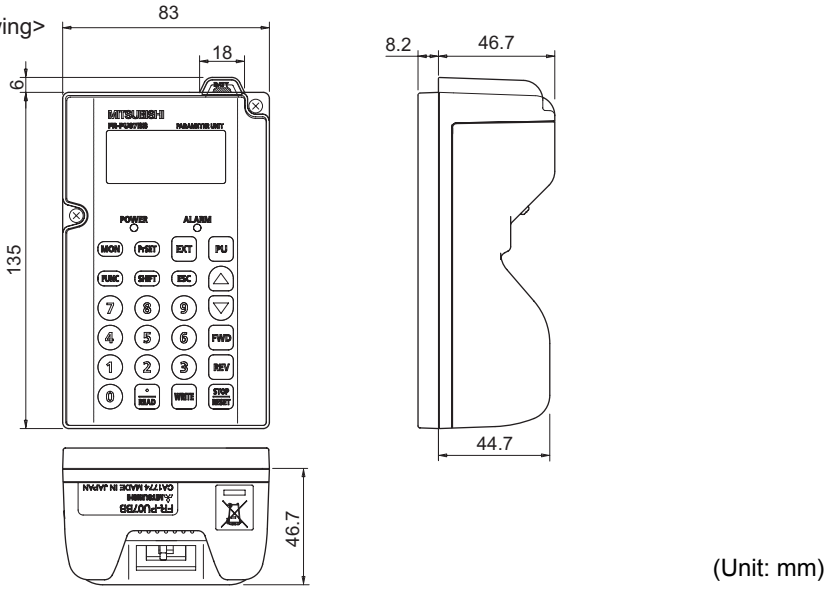
*1 When mounting FR-PU07 to an enclosure, etc., remove the screws used for mounting to the converter, or use M3 nut to securely mount the FR-PU07.

*2 Select the installation screw whose length will not exceed the effective depth of the installation screw hole.

(Unit: mm)

●Parameter unit with battery pack (option)(FR-PU07BB)

<Outline drawing>



(Unit: mm)

APPENDICES

This chapter provides the "APPENDICES" of this product. Always read the instructions before using the equipment.

Appendix 1 Instruction code list..... 174
Appendix 2 Instructions for compliance with the EU Directives..... 175
Appendix 3 Instructions for UL and cUL 177

Appendix 1 Instruction code list

*1 These instruction codes are used to write or read parameters through the RS-485 communication and the CC-Link communication. (*Refer to page 94* for the RS-485 communication. *Refer to page 105* for the CC-Link communication.)

*2 "O" indicates valid and "×" indicates invalid of "parameter copy", "parameter clear", and "all parameter clear".

*3 These parameters are not cleared by the parameter clear (all parameter clear) command, which are sent through RS-485 communication and CC-Link communication. (*Refer to page 94* for the RS-485 communication. *Refer to page 105* for the CC-Link communication.)

*4 Read and write of this parameter is enabled only when communicating through the PU connector.

Symbols in the table indicate parameters that function when the option is mounted.

NC FR-A7NC

Pr.	Name	Instruction Code*1			Parameter*2		
		Read	Write	Extended	Copy	Clear	All clear
0	Simple mode selection	00	80	0	O	O	O
1	Maximum power supply frequency	01	81	0	O	O	O
2	Minimum power supply frequency	02	82	0	O	O	O
3	ROH terminal function selection	03	83	0	O	×	O
4	SOF terminal function selection	04	84	0	O	×	O
5	X1 terminal function selection	05	85	0	O	×	O
6	X2 terminal function selection	06	86	0	O	×	O
7	RES terminal function selection	07	87	0	O	×	O
8	SOF input selection	08	88	0	O	×	O
9	OH input selection	09	89	0	O	×	O
10	RDY signal logic selection	0A	8A	0	O	×	O
11	RSO terminal function selection	0B	8B	0	O	×	O
12	CVO terminal function selection	0C	8C	0	O	×	O
13	Y1 terminal function selection	0D	8D	0	O	×	O
14	Y2 terminal function selection	0E	8E	0	O	×	O
15	Y3 terminal function selection	0F	8F	0	O	×	O
16	ABC terminal function selection	10	90	0	O	×	O
22	Current limit level	16	96	0	O	O	O
23	Current limit level (regenerative)	17	97	0	O	O	O
24	OL signal output timer	18	98	0	O	O	O
25	Input current detection level	19	99	0	O	O	O
26	Input current detection signal delay time	1A	9A	0	O	O	O
27	Input current detection signal retention time	1B	9B	0	O	O	O
28	Input current detection operation selection	1C	9C	0	O	O	O
29	Zero current detection level	1D	9D	0	O	O	O
30	Zero current detection time	1E	9E	0	O	O	O
31	Life alarm status display	1F	9F	0	O	×	×
32	Inrush current limit circuit life display	20	A0	0	O	×	×
33	Control circuit capacitor life display	21	A1	0	O	×	×
34	Maintenance timer	22	A2	0	×	×	×
35	Maintenance timer alarm output set time	23	A3	0	O	×	O
36	Cooling fan operation selection	24	A4	0	O	O	O
44	Instantaneous power failure detection signal clear	2C	AC	0	O	×	O
45	AM output filter	2D	AD	0	O	O	O
46	Watt-hour meter clear	2E	AE	0	O	×	O
47	Energization time carrying-over times	2F	AF	0	×	×	×
48	Cumulative power monitor digit shifted times	30	B0	0	O	O	O
49	Power supply frequency monitoring reference	31	B1	0	O	O	O
50	AM terminal function selection	32	B2	0	O	O	O
51	Input power monitoring reference	33	B3	0	O	O	O
52	DU/PU main display data selection	34	B4	0	O	O	O
53	Input voltage monitoring reference	35	B5	0	O	O	O
54	FM terminal function selection	36	B6	0	O	O	O
55	Bus voltage monitoring reference	37	B7	0	O	O	O
56	Current monitoring reference	38	B8	0	O	O	O
57	Restart selection	39	B9	0	O	O	O
58	Free parameter 1	3A	BA	0	O	×	×
59	Free parameter 2	3B	BB	0	O	×	×
61	Key lock operation selection	3D	BD	0	O	×	O
65	Retry selection	41	C1	0	O	O	O
67	Number of retries at fault occurrence	43	C3	0	O	O	O
68	Retry waiting time	44	C4	0	O	O	O
69	Retry count display erase	45	C5	0	O	O	O
75	Reset selection/disconnected PU detection/PU stop selection	4B	CB	0	O	×	×
77*4	Parameter write selection	4D	CD	0	O	O	O
80	Voltage control proportional gain	50	D0	0	O	O	O
81	Voltage control integral gain	51	D1	0	O	O	O
82	Current control proportional gain	52	D2	0	O	O	O
83	Current control integral gain	53	D3	0	O	O	O
117	PU communication station number	11	91	1	O	O*3	O*3
118	PU communication speed	12	92	1	O	O*3	O*3
119	PU communication stop bit length	13	93	1	O	O*3	O*3
120	PU communication parity check	14	94	1	O	O*3	O*3
121	Number of PU communication retries	15	95	1	O	O*3	O*3
123	PU communication waiting time setting	17	97	1	O	O*3	O*3
124	PU communication CR/LF selection	18	98	1	O	O*3	O*3
145	PU display language selection	2D	AD	1	O	×	×
269	Parameter for manufacturer setting. Do not set.						
342	Communication EEPROM write selection	2A	AA	3	O	O	O
500	Communication error execution waiting time NC	00	80	5	O	O	O
501	Communication error occurrence count display NC	01	81	5	×	O	O
502	Stop mode selection at communication error NC	02	82	5	O	O	O
542	Communication station number (CC-Link) NC	2A	AA	5	O	O*3	O*3
543	Baud rate (CC-Link) NC	2B	AB	5	O	O*3	O*3
544	CC-Link extended setting NC	2C	AC	5	O	O*3	O*3
C0 (900)	FM terminal calibration	5C	DC	1	O	×	O
C1 (901)	AM terminal calibration	5D	DD	1	O	×	O
989	Parameter copy alarm release	59	D9	9	O	×	O
990	PU buzzer control	5A	DA	9	O	O	O
991	PU contrast adjustment	5B	DB	9	O	×	O

Appendix 2 Instructions for compliance with the EU Directives

The EU Directives are issued to standardize different national regulations of the EU Member States and to facilitate free movement of the equipment, whose safety is ensured, in the EU territory.
Since 1996, compliance with the EMC Directive that is one of the EU Directives has been legally required. Since 1997, compliance with the Low Voltage Directive, another EU Directive, has been also legally required. When a manufacturer confirms its equipment to be compliant with the EMC Directive and the Low Voltage Directive, the manufacturer must declare the conformity and affix the CE marking.

● The authorized representative in the EU

The authorized representative in the EU is shown below.
Name: Mitsubishi Electric Europe B.V.
Address: Gothaer Strasse 8, 40880 Ratingen, Germany

● Note

We declare that this converter, when equipped with the dedicated EMC filter, conforms with the EMC Directive in industrial environments and affix the CE marking on the inverter.
When using the inverter in a residential area, take appropriate measures and ensure the conformity of the inverter used in the residential area.

(1) EMC Directive

We declare that this converter, when equipped with the EMC Directive compliant EMC filter, conforms with the EMC Directive and affix the CE marking on the inverter (except the single-phase 100V power supply model).

- EMC Directive: 2004/108/EC
- Standard(s): EN61800-3:2004 (Second environment / PDS Category "C3")

Note: First environment

Environment including residential buildings. Includes building directly connected without a transformer to the low voltage power supply network which supplies power to residential buildings.

Second environment

Environment including all buildings except buildings directly connected without a transformer to the lower voltage power supply network which supplies power to residential buildings.

● Note

∗ Set the EMC Directive compliant EMC filter to the converter. Use a recommended EMC compliant EMC filter shown in the table below. Insert line noise filters and ferrite cores to the power and control cables as required.

- Recommended EMC compliant EMC filter (Manufactured by: SOSHIN ELECTRIC CO.,LTD.)

200V class

	FR-HC2-7.5K	FR-HC2-15K	FR-HC2-30K	FR-HC2-55K	FR-HC2-75K
EMC compliant EMC filter	HF3040 C-UQC	HF3080 C-UQC	NF3150 A-VZ	NF3250 C-VZ	NF3300 C-VZ

400V class

	FR-HC2-H75K	FR-HC2-H110K	FR-HC2-H280K
EMC compliant EMC filter	TF3150C-TX	NF3250C-UQA	NF3600C-SDK

∗ Connect the converter to an earthed power supply.
∗ Install a motor, the EMC Directive compliant EMC filter, and a control cable according to the instructions written in the EMC Installation Guidelines (BCN-A21041-204).
∗ Confirm that the final integrated system with the inverter conforms with the EMC Directive.
∗ Mount the converter (including all peripheral devices such as outside box, reactor 1, and reactor 2) to the enclosure panel of IP54 or higher.

(2) Low Voltage Directive

We have self-confirmed our converters as products compliant to the Low Voltage Directive (Conforming standard EN 61800-5-1) and affix the CE marking on the converters.

Outline of instructions

* Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
* Wire the earth (ground) terminal independently. (Do not connect two or more cables to one terminal.)
* Use the cable sizes on *page 29, 46* under the following conditions.
  •Surrounding air temperature: 40°C maximum
  If conditions are different from above, select appropriate wire according to EN60204 ANNEX C TABLE 5.
* Use a tinned (plating should not include zinc) crimping terminal to connect the earth cable. When tightening the screw, be careful not to damage the threads.
  For use as a product compliant with the Low Voltage Directive, use PVC cable on *page 29, 46*.
* Use the moulded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
* When using an earth leakage circuit breaker, use a residual current operated protective device (RCD) of type B (breaker which can detect both AC and DC). If not, provide double or reinforced insulation between the converter and other equipment, or put a transformer between the main power supply and converter.
* Use the inverter under the conditions of overvoltage category II (usable regardless of the earth (ground) condition of the power supply), overvoltage category III (usable with the earthed-neutral system power supply, 400V class only) specified in IEC664.
  • Mount the converter (including all peripheral devices such as outside box, reactor 1, and reactor 2) to the enclosure panel of IP54 or higher.
* On the input and output of the converter, use cables of the type and size set forth in EN60204 Appendix C.
* The operating capacity of the relay outputs (terminal symbols A, B, C) should be 30VDC, 0.3A. (Relay output has basic isolation from the inverter internal circuit.)
* Control circuit terminals on *page 31, 44* are safely isolated from the main circuit.
* Environment

	Running	In Storage	During Transportation
Surrounding air temperature	-10°C to +50°C	-20°C to +65°C	-20°C to +65°C
Humidity	90% RH or less	90% RH or less	90% RH or less
Maximum Altitude	1000m	1000m	10000m

Details are given in the technical information "Low Voltage Directive Conformance Guide" (BCN-A21041-203). Please contact your sales representative.

* Provide the Class T fuse or a fuse with faster shutoff speed, which is UL and cUL listed, for branch circuit protection.

Converter model	Fuse type	Cat. No	Manufacturer	Rating
FR-HC2-7.5K	UL Recognized High Speed	170M1414	Bussmann	50A, 660 Vac
FR-HC2-15K	UL Recognized High Speed	170M1416	Bussmann	80A, 660 Vac
FR-HC2-30K	UL Recognized High Speed	170M2666	Bussmann	160A, 700 Vac
FR-HC2-55K	UL Recognized High Speed	170M2669	Bussmann	315A, 700 Vac
FR-HC2-75K	UL Recognized High Speed	170M2671	Bussmann	400A, 700 Vac
FR-HC2-H75K	UL Recognized High Speed	170M2667	Bussmann	200A, 700 Vac
FR-HC2-H110K	UL Recognized High Speed	170M2669	Bussmann	315A, 700 Vac
FR-HC2-H280K	UL Recognized High Speed	170M4117	Bussmann	700A, 700Vac
FR-HC2-H560K	UL Recognized High Speed	170M6117	Bussmann	1400A, 700 VAC

Appendix 3 Instructions for UL and cUL

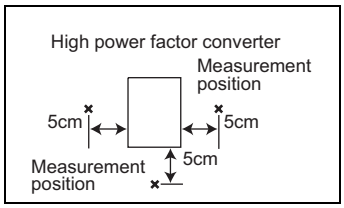
(Standard to comply with: UL 508C, CSA C22.2 No. 14)

(1) General Precaution

The bus capacitor discharge time is 10 minutes. Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for residual voltage between terminal P/+ and N/- with a meter etc., to avoid a hazard of electrical shock.

(2) Environment

Before installation, check that the environment meets following specifications.

Surrounding air temperature *1	-10°C to + 50°C Maximum (non-freezing) **Enclosure** 
Ambient humidity	90%RH or less (non-condensing)
Storage temperature	-20°C to + 65°C
Ambience	Indoors (No corrosive and flammable gases, oil mist, dust and dirt.)
Altitude, vibration	Below 1000m, 5.9m/s^2 or less at 10 to 55Hz (directions of X, Y, Z axes) *2

*1 Surrounding Air Temperature is a temperature measured at a measurement position in an enclosure. Ambient Temperature is a temperature outside an enclosure.

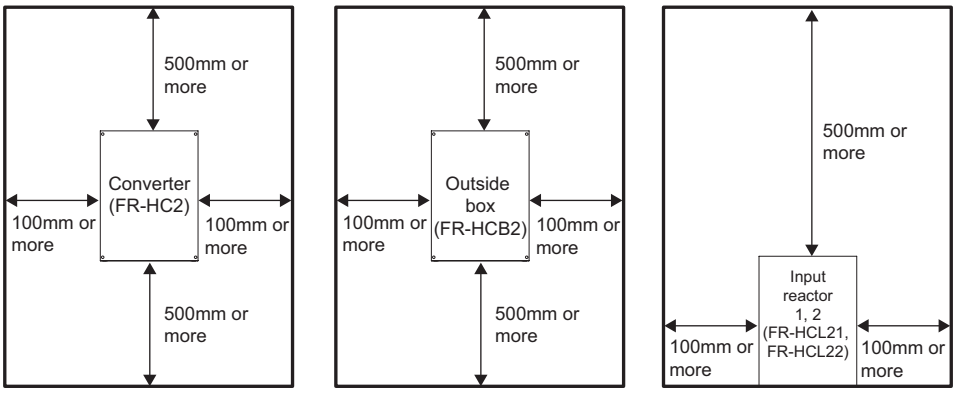
*2 2.9m/s^2 or less for the 280K or higher

(3) Installation

- High power factor converter (FR-HC2) and its accessories are open type devices which must be installed inside a separate and suitable Type 1 enclosure along with the external components (Input reactors, Magnetic Contactor, Pre-Charge Resistor, Capacitors and Transformer).
- Make the necessary wiring connections in accordance with the NEC for installations in North America, CEC for Canada and any applicable local codes.
- For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code and any applicable provincial codes.
  For installation in Canada, branch circuit protection must be provided in accordance with the Canadian Electrical Code and any applicable provincial codes.
  Provide the appropriate fuse in accordance with the table below.

Converter model	Fuse type	Cat. No	Manufacturer	Rating
FR-HC2-7.5K	UL Recognized High Speed	170M1414	Bussmann	50A, 660 Vac
FR-HC2-15K	UL Recognized High Speed	170M1416	Bussmann	80A, 660 Vac
FR-HC2-30K	UL Recognized High Speed	170M2666	Bussmann	160A, 700 Vac
FR-HC2-55K	UL Recognized High Speed	170M2669	Bussmann	315A, 700 Vac
FR-HC2-75K	UL Recognized High Speed	170M2671	Bussmann	400A, 700 Vac
FR-HC2-H75K	UL Recognized High Speed	170M2667	Bussmann	200A, 700 Vac
FR-HC2-H110K	UL Recognized High Speed	170M2669	Bussmann	315A, 700 Vac
FR-HC2-H280K	UL Recognized High Speed	170M4117	Bussmann	700A, 700Vac
FR-HC2-H560K	UL Recognized High Speed	170M6117	Bussmann	1400A, 700 Vac

- Due to Type 1 enclosure variables of size, cooling fans, ventilation and location, be sure to monitor the surrounding air temperature of the converter to not exceed 50°C. Use additional cooling means as necessary.
- Install all appended accessories inside the enclosure.
- Minimum spacing distances inside the enclosure are as follows.



(4) Wiring to the power supply and the motor

(1) Wiring the converter with the inverter

Use the UL listed copper stranded wire (rated at 75°C) for wiring between the inverter and the converter (P and N), and between the converter and input reactor (R4, S4, T4). When wiring to the terminals, refer to the following table, and use the UL listed crimp ring terminal employing insulation tubing. Crimp the crimping terminals with the crimping tool recommended by the terminal manufacturer.

Converter model	Main Circuit-Terminal Screw Size	Recommended Criming Terminal by JST Mfg. Co., Ltd.		Recommended Tool by JST Mfg. Co., Ltd.		Tightening-Torque (N•m)	Cable Size	
							AWG or kcmil for R4, S4, T4, P, N terminals	
		R4/L14, S4/L24, T4/L34	P/+, N/-	Terminal crimping tool	Crimping head		R4/L14, S4/L24, T4/L34	P/+, N/-
FR-HC2-7.5K	M5	8-5	8-5	YF-1, E-4	YET-150-1	2.5	8	8
FR-HC2-15K	M6	22-6	22-6			4.4	4	4
FR-HC2-30K	M8/M10	60-8	60-10			7.8/14.7	1/0	1/0
FR-HC2-55K	M12	150-12	150-12			24.5	300	300
FR-HC2-75K	M12	150-12	150-12			24.5	300	300
FR-HC2-H75K	M10	38-10	38-10			14.7	1	1
FR-HC2-H110K	M10	60-10	60-10			14.7	1/0	2/0
FR-HC2-H280K	M12	200-12	150-12			24.5	400	2 × 350
FR-HC2-H560K	M12	RD325-12	RD325-12		YET-300-1, YET-300N	24.5	3 × 600	3 × 600

(2) The FR-HCB2 Series unit is a UL Listed Accessory for use only with the following converter.

FR-HCB2 Series unit	Applicable Converter
FR-HCB2-7.5K	FR-HC2-7.5K
FR-HCB2-15K	FR-HC2-15K
FR-HCB2-30K	FR-HC2-30K
FR-HCB2-55K	FR-HC2-55K
FR-HCB2-75K	FR-HC2-75K
FR-HCB2-H75K	FR-HC2-H75K
FR-HCB2-H110K	FR-HC2-H110K

MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Aug. 2009	IB(NA)-0600381ENG-A	First edition
Jan. 2010	IB(NA)-0600381ENG-B	Modification · Compatibility with FR-A7NC · Additional peripheral devices Inrush current limit resistor (with thermostat) (partial change) Buffer relay (SR-N4FX AC210V 4A) Mini relay for filter capacitor alarm detector (MYQ4Z AC200/220) Mini relay terminal block (PYF14T) Mini relay clip (PYC-A1)
Jul. 2010	IB(NA)-0600381ENG-C	Addition · FR-HC2-7.5K to 75K · Pr. 44 Instantaneous power failure detection signal clear · Monitored item: input power (with regenerative display) · Output signal: Instantaneous power failure detection hold (Y16) Modification · Fuse selection
Sep. 2011	IB(NA)-0600381ENG-D	Addition · FR-HC2-H75K, H110K, H280K

⚠ For Maximum Safety

- Mitsubishi converters are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product are likely to cause a serious accident.

MITSUBISHI ELECTRIC CORPORATION
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